WHAT IS CLAIMED IS:

1. A method of editing an endogenous gene in a population of T cells *in vitro*, the method comprising: contacting the population of T cells with a gene editing reagent or a polynucleotide encoding a gene editing reagent under conditions to allow the polynucleotide or gene editing reagent to enter the cell, and culturing the population of T cells in the presence of one or more of; insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist before and/or during, and/or after the contacting step to obtain an engineered population of T cells.

2. The method of claim 1, further comprising contacting the population of T cells with a donor DNA.

3. The method of claim 1 or 2, wherein the polynucleotide encoding the gene editing reagent comprises: single-stranded DNA, double-stranded DNA, a linear DNA strand, a plasmid, a nanoplasmid, or a minicircle.

4. The method of claim 3, wherein the polynucleotide encoding the gene editing reagent comprises a plasmid comprising a plasmid backbone and a polynucleotide sequence encoding the gene editing reagent.

5. The method of claim 4, wherein the plasmid further comprises the donor DNA.

6. The method of any one of claims 2 to 5, wherein the donor DNA sequence comprises a polynucleotide encoding a gene product.

7. The method of claim 6, wherein the population of T cells was obtained from a subject.

8. The method of claim 7, wherein the gene product sequence comprises a chimeric antigen receptor (CAR), a T cell receptor (TCR), a human leukocyte antigen (HLA), or an alloimmune defense receptor (ADR), or a subunit thereof.

9. The method of claim 8, wherein the TCR sequence comprises an exogenous TCR-beta subunit or fragment thereof and/or an exogenous TCR-alpha subunit or fragment thereof, or a chimeric antigen receptor and/or subunit thereof.

10. The method of claim 9, wherein the TCR sequence comprises an exogenous TCR-beta subunit or fragment thereof and an exogenous TCR-alpha subunit or fragment thereof.

11. The method of claim 10, wherein the TCR sequence is inserted in a TRAC or TRBC locus.

12. The method of claim 10, wherein the TCR sequence is inserted in a TRAC locus.

13. The method of claim 10, wherein the TCR sequence is inserted in a TRBC locus.

14. The method of claim 1 or 2, wherein contacting the population of T cells with the gene editing reagent or polynucleotide encoding the gene editing reagent comprises transfecting the population of T cells with the gene editing reagent or polynucleotide encoding the gene editing reagent.

15. The method of claim 14, wherein the transfecting comprises electroporation.

16. The method of claim 14, wherein the transfecting comprises nucleofection.

17. The method of claim 14, wherein the transfecting comprises lipid transfection.

18. The method of claim 14, wherein the transfecting comprises microfluidic transfection.

19. The method of any one of claims 1-18, wherein the population of T cells is cultured in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist prior to the contacting step.

20. The method of claim 19, comprising culturing the population of T cells in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist for 48 hours, 24 hours, 12 hours, 6 hours, 4 hours, 2 hours, 1 hour, or 30 minutes prior to the contacting step.

21. The method of any one of claims 1-18, wherein the population of T cells is cultured in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist after the contacting step.

22. The method of claim 21, comprising culturing the population of T cells in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist for 48 hours, 24 hours, 12 hours, 6 hours, 4 hours, 2 hours, 1 hour, or 30 minutes after the contacting step.

23. The method of any one of claims 1-18, wherein the population of T cells is cultured in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist prior to and after the contacting step.

24. The method of claim 23, comprising culturing the population of T cells in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist for 48 hours, 24 hours, 12 hours, 6 hours, 4 hours, 2 hours, 1 hour, or 30 minutes prior to the contacting step.

25. The method of claim 23 or 24, comprising culturing the population of T cells in the presence of insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist for 48 hours, 24 hours, 12 hours, 6 hours, 4 hours, 2 hours, 1 hour, or 30 minutes after the contacting step.

26. The method of any one of claims 1-25, wherein the insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist is present at a concentration of 1 µg/ml to 50 µg/ml.

27. The method of claim 26, wherein the insulin, an insulin analog, an insulin agonist and/or an insulin partial agonist is present at a concentration of about 1 µg/ml, about 5 µg/ml, or about 25 µg/ml.

28. The method of claim 27, wherein the population of T cells is transfected with the donor DNA and the gene editing agent or the polynucleotide encoding the gene editing reagent simultaneously.

29. The method of any one of claims 1-28, wherein the gene editing reagent comprises an RNA-guided nuclease.

30. The method of claim 29, wherein the RNA-guided nuclease is a CRISPR-Cas system.

31. The method of claim 30, wherein the CRISPR-Cas system comprises a Cas9 or a Cas9 variant.

32. The method of any one of claims 1-31, wherein the gene editing reagent comprises a CRISPR-Cas system comprising a Cas protein and a guide RNA.

33. The method of any one of claims 1-32, wherein at least 80 % of engineered T cells are T central memory (TCM) and/or T stem cell memory (TSCM).

34. A method of monitoring of cell viability for an engineered population of T cells, the method comprising measuring mitochondrial function and cell metabolism over time.

35. The method of claim 34, wherein the mitochondrial membrane potential is measured.

36. The method of claim 35, wherein the mitochondrial membrane potential is measured using a dye-based assay.

37. The method of claim 36, wherein the dye is JC-1 or JC-10.

38. A method of monitoring cell viability for an engineered population of T cells, the method comprising measuring a cell metabolism marker over time.

39. The method of claim 38, wherein the method comprises measuring changes in glucose metabolism, Bcl-2 expression, Bcl-XL expression, Bax expression, or Bad expression over time.

40. The method of claim 39, wherein the engineered population of T cells glucose metabolism is monitored using a glucose analog.

41. The method of claim 40, wherein the analog is 2-NBDG.

42. The method of any one of claims 1-33, wherein the engineered population of T cells has increased cell viability, growth, and/or gene editing efficiencies relative to a population of engineered T cells that are not contacted with insulin, an insulin analog, an insulin agonist, or an insulin partial agonist.

43. The method of claim 42, wherein the cell viability and culture performance for the engineered population of T cells is monitored, the method comprising measuring mitochondrial function and cell metabolism over time.

44. The method of claim 42 or 43, wherein the cell viability and culture performance for a population of T cells is monitored, the method comprising measuring a cell metabolism marker over time.

45. The method of claim 44, wherein the method comprises measuring changes in glucose metabolism over time.

46. The method of any one of claims 43-45, wherein the cell viability of the engineered population of T cells is increased (a) from at least 0.1 fold to at least 5.0 fold or (b) about 2.0 fold, relative to a population of engineered T cells that are not cultured in the presence of insulin, an insulin analog, an insulin agonist, or an insulin partial agonist.

47. The method of any one of claims 43-46, wherein the cell viability of the engineered population of T cells is from 30% to 95%.

48. The method of any one of claims 1-33, wherein the engineered population of T cells has increased gene editing efficiency relative to a population of engineered T cells that are not contacted with insulin, insulin analog, insulin agonist, or insulin partial agonist.

49. The method of claim 48, wherein the gene editing efficiency of the engineered population of T cells is increased (a) from at least 0.1 fold to at least 5 fold or (b) from 2.0 fold to 3.0 fold, relative to a population of engineered T cells that are not contacted with insulin, an insulin analog, an insulin agonist, and/or an insulin partial agonist.

50. The method of claim 49, wherein the gene editing efficiency of the engineered population of T cells is from 1% to 99% and/or the knock-out efficiency of the population of engineered T cells is from 70% to 99%.

51. The method of any one of claims 48-50, wherein knock-in efficiency of the engineered population of T cells is (a) from 20% to 99% or (b) about 60%.

52. The method of any one of claims 1-33, further comprising

expanding the engineered population of T cells, thereby forming a population of expanded engineered T cells,

wherein the insulin, insulin analog, insulin agonist, and/or insulin partial agonist increases the population of expanded engineered T cells relative to a population of engineered T cells that are not contacted with insulin, insulin analog, insulin agonist, and/or insulin partial agonist.

53. The method of claim 52, wherein the population of expanded engineered T cells is increased from (a) at least 0.1 fold to at least 5.0 fold, (b) 2.0 fold to 3.0 fold, (c) at least 0.1 fold to at least 1000 fold, or (d) about 20 fold relative to a population of engineered T cells that are not contacted with insulin, insulin analog, insulin agonist, and/or insulin partial agonist.

54. An engineered population of T cells, made by the method of any one of claims 1-53.

55. A pharmaceutical composition comprising the engineered T cell of claim 54.

56. Use of the engineered T cell of claim 54 or the pharmaceutical composition of claim 55, in the manufacture of a medicament for treating a disease in a subject in need thereof.