

What is claimed:

1. A chimeric antigen receptor comprising an antigen binding molecule that specifically binds to FLT3, a costimulatory domain, and an activating domain that is a signaling domain of CD3 zeta, wherein the antigen binding molecule comprises:
 - a) a variable heavy chain region comprising complementary determining regions (“CDRs”) 1, 2, and 3 with amino acid sequences SEQ ID NO:17, SEQ ID NO:26, and SEQ ID NO:27, respectively, and a variable light chain region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO:30, SEQ ID NO:31, and SEQ ID NO:32, respectively; or
 - b) a variable heavy chain region comprising complementary determining regions (“CDRs”) 1, 2, and 3 with amino acid sequences SEQ ID NO:43, SEQ ID NO:44, and SEQ ID NO:45, respectively, and a variable light chain region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO:48, SEQ ID NO:49, and SEQ ID NO:50, respectively; or
 - c) a variable heavy chain region comprising complementary determining regions (“CDRs”) 1, 2, and 3 with amino acid sequences SEQ ID NO:53, SEQ ID NO:54, and SEQ ID NO:55, respectively, and a variable light chain region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO:58, SEQ ID NO:59, and SEQ ID NO:60, respectively;and the costimulatory domain is a CD28 costimulatory domain comprising a sequence of SEQ ID NO: 2, SEQ ID NO: 4, or SEQ ID NO: 4 in combination with SEQ ID NO: 6 or SEQ ID NO: 8.
2. The chimeric antigen receptor according to claim 1 wherein the CD3 zeta comprises a sequence that differs at no more than 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, or 0 amino acid residues from the sequence of SEQ ID NO: 10.
3. The chimeric antigen receptor according to claim 1 wherein the costimulatory domain comprises a sequence that differs at no more than 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, or 0 amino acid residues from the sequence of SEQ ID NO: 2 and the activating domain comprises a sequence that differs at no more than 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, or 0 amino acid residues from the sequence of SEQ ID NO: 10.

4. A polynucleotide encoding the chimeric antigen receptor of claim 1.
5. A vector comprising the polynucleotide of claim 4.
6. The vector according to claim 5 which is a retroviral vector, a DNA vector, a plasmid, a RNA vector, an adenoviral vector, an adenovirus associated vector, a lentiviral vector, or any combination thereof.
7. An immune cell comprising the vector of claim 5.
8. The immune cell according to claim 7, wherein the immune cell is a T cell, tumor infiltrating lymphocyte (TIL), NK cell, TCR-expressing cell, dendritic cell, or NK-T cell.
9. The immune cell according to claim 8, wherein the cell is an autologous T cell.
10. The immune cell according to claim 8, wherein the cell is an allogeneic T cell.
11. The immune cell of claim 7, wherein the vector is introduced into a cell that is isolated from a patient's body or that is grown from a sample taken from a patient's body.
12. The immune cell of claim 7, wherein the vector is introduced into a cell that is isolated from a donor's body or that is grown from a sample taken from a patient's body.
13. A pharmaceutical composition comprising an immune cell of claim 7.
14. An isolated polypeptide comprising the amino acid sequence of SEQ ID NO:76 or SEQ ID NO:82.
15. A vector encoding the polypeptide of claim 14.
16. An immune cell comprising the polypeptide of claim 14.
17. The immune cell according to claim 16, wherein the immune cell is a T cell, tumor infiltrating lymphocyte (TIL), NK cell, TCR-expressing cell, dendritic cell, or NK-T cell.
18. The T cell of claim 17 that is an autologous T cell.
19. The T cell of claim 17 that is an allogeneic T cell.
20. An isolated polynucleotide encoding a chimeric antigen receptor (CAR), said CAR comprising an antigen binding molecule that specifically binds to FLT3, wherein the antigen binding molecule comprises the polynucleotide sequence SEQ ID NO:75 or SEQ ID NO:81.

21. The polynucleotide according to claim 4 or 20, the polypeptide according to claim 14, the chimeric antigen receptor according to claim 1, the cell according to claim 7 or 16, or the pharmaceutical composition according to claim 13 for use in treating a disease or a disorder.

22. Use of the polynucleotide according to claim 4 or 20, in the manufacture of a medicament for treating cancer wherein the cancer is selected from the group consisting of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma, and inflammatory/autoimmune disease; wherein the inflammatory/autoimmune disease is selected from the group consisting of rheumatoid arthritis, psoriasis, allergies, asthma, Crohn's disease, IBD, IBS, fibromyalgia, mastocytosis, and Celiac disease.

23. Use of the polypeptide according to claim 14 in the manufacture of a medicament for treating cancer wherein the cancer is selected from the group consisting of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma), and inflammatory/autoimmune disease; wherein the inflammatory/autoimmune disease is selected from the group consisting of rheumatoid arthritis, psoriasis, allergies, asthma, Crohn's disease, IBD, IBS, fibromyalgia, mastocytosis, and Celiac disease.

24. Use of the chimeric antigen receptor according to claim 1 in the manufacture of a medicament for treating cancer wherein the cancer is selected from the group consisting of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma), and inflammatory/autoimmune disease; wherein the inflammatory/autoimmune disease is selected from the group consisting of rheumatoid arthritis, psoriasis, allergies, asthma, Crohn's disease, IBD, IBS, fibromyalgia, mastocytosis, and Celiac disease.

25. Use of the cell according to claim 7 or 16, in the manufacture of a medicament for treating cancer wherein the cancer is selected from the group consisting of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma), and inflammatory/autoimmune disease; wherein the inflammatory/autoimmune disease is selected from the group consisting of rheumatoid arthritis, psoriasis, allergies, asthma, Crohn's disease, IBD, IBS, fibromyalgia, mastocytosis, and Celiac disease.

26. Use of the pharmaceutical composition according to claim 13 in the manufacture of a medicament for treating cancer wherein the cancer is selected from the group consisting of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma), and inflammatory/autoimmune disease; wherein the inflammatory/autoimmune disease is selected from the group consisting of rheumatoid arthritis, psoriasis, allergies, asthma, Crohn's disease, IBD, IBS, fibromyalgia, mastocytosis, and Celiac disease.

27. The use according to any of claims 21, 22, 23, 24 or 25 wherein the cancer is leukemia, lymphoma, or myeloma.

28. The use according to any of claims 21, 22, 23, 24 or 25, wherein the cancer is AML.

29. The lentiviral vector according to claim 6, wherein the lentiviral vector is a pGAR vector.