CLAIMS

1. A polypeptide comprising a Tc1/*mariner* superfamily transposase capable of mobilizing a transposon, wherein the polypeptide comprises a nuclear export signal and a chaperone-mediated autophagy signal and wherein the transposase is selected from the group comprising Sleeping Beauty, Frog Prince, Minos, ZB and Passport transposase, preferably, Sleeping Beauty transposase.

2. The polypeptide of claim 1, wherein the polypeptide comprises an SB100X transposase having an amino acid sequence having at least 80% sequence identity to SEQ ID NO: 43, wherein, preferably, the polypeptide further has an amino acid sequence having at least 80% sequence identity to SEQ ID NO: 50.

3. The polypeptide of any of the preceding claims, wherein the chaperone-mediated autophagy signal has an amino acid sequence selected from the group comprising SEQ ID NO: 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41 and 42.

4. An RNA enconding the polypeptide of any of the preceding claims, wherein the RNA comprises a 5'UTR and a 3'UTR, wherein the 5'UTR is seleceted from the group comprising a β-globin 5'UTR and a 5'UTR comprising an eIF4G aptamer.

5. The RNA of claim 4, wherein the 3'UTR is selected from the group consisting of one or more β-globin 3'UTRs, an α-globin 2 3'UTR, a 3'UTR comprising a WPRE, a βα-globin 3'UTR and a truncated β-globin 3'UTR.

6. The RNA of any of claims 4 or 5, wherein the RNA comprises
   a) a β-globin 5'UTR and two β-globin 3'UTRs;
   b) a β-globin 5'UTR and a truncated β-globin 3'UTR;
   c) a β-globin 5'UTR and an α -globin 2 3'UTR
   d) a β-globin 5'UTR and a βα-globin 3'UTR; or
   e) a 5'UTR comprising an eIF4G aptamer and two β-globin 3'UTRs.

7. The RNA of any of claims 4 to 6, wherein the RNA is codon-optimized.

8. The RNA of any of claims 4 to 7, wherein the RNA comprises a poly-A tail having a length of 50 to 150 nt, preferably 75 to 100 nt, such as 90 nt.

9. The RNA of any of claims 4 to 8, wherein the RNA comprises a 5' Cap1 structure.

10. The RNA of any of claims 4 to 9, wherein the RNA comprises one or more modified nucleosides selected from the group comprising 5-methyl-CTP, N4-acetyl-CTP, Pseudo-UTP, N1-methylpseudo-UTP, 6-methoxy-UTP, 2-thio-UTP, N6-methyl-ATP and N1-methyl-ATP.

11. The RNA of any of claims 4 to 10, wherein the RNA comprises a nucleic acid sequence of SEQ ID NO: 62, 63, 64, 65, 66, 67, 68, or 69, preferably SEQ ID NO: 69.

12. A vector for introducing the RNA of any of claims 4 to 11 and, optionally, the polypeptide of claims 1 to 3 into a target cell, wherein the vector comprises a nucleic acid encoding the RNA of any of claims 4 to 11 or the polypeptide of any of claims 1 to 3, or wherein the vector comprises the RNA of any of claims 4 to 11 or the polypeptide of any of claims 1 to 3.

13. A cell comprising the RNA of any of claims 4 to 11 and/or the polypeptide of any of claims 1-3; wherein, preferably, the cell is a human cell selected from the group comprising a pluripotent stem cell and a human lymphocyte, optionally, a human T lymphocyte.

14. A kit comprising
    a) the polypeptide of any of claims 1 to 3, the RNA of any of claims 4 to 11, the vector of claim 12 and/or the cell of claim 13; and
    b) a nucleic acid comprising a cargo nucleic acid flanked by terminal inverted repeats (TIR) of a transposon capable of being mobilized by said transposase.

15. A pharmaceutical composition comprising the polypeptide of any of claims 1-3, the RNA of any of claims 4 to 11; the vector of claim 12, the cell of claim 13, and/or the kit of claim 14 and, optionally, a pharmaceutically acceptable carrier and/or excipient.

16. Use of the polypeptide of any of claims 1-3, the RNA of any of claims 4 to 11; the vector of claim 12, the cell of claim 13, and/or the kit of claim 14 and, optionally, a pharmaceutically acceptable carrier and/or excipient in the manufacture of a medicament for adoptive T cell therapy or gene therapy.

17. Use of the polypeptide of any of claims 1-3, the RNA of any of claims 4 to 11, the vector of claim 12, the cell of claim 13 or the kit of claim 14 in the manufacture of a medicament for introducing an exogenous nucleic acid into the genome of a cell.

18. An in vitro method for preparing a cell with an exogenous nucleic acid integrated into the genome of the cell, comprising steps of
    a) providing to the cell the polypeptide of any of claims 1-3 or the RNA of any of claims 4 to 11; and
    b) providing to the cell a nucleic acid comprising the exogenous nucleic acid flanked by terminal inverted repeats (TIR) of a transposon capable of being mobilized by said polypeptide or a polypeptide encoded by said RNA.