[0020] Other embodiments of the present disclosure relate to a method of treating a disease or condition associated with a telomere abnormality, comprising: i. isolating one or more human cells from a subject suffering from a disease or condition associated with a telomere abnormality; ii. contacting the one or more human cells with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces telomere lengthening in the one or more human cells; and iii. administering the contacted one or more human cells to the subject to treat the disease or condition associated with a telomere abnormality.

[0020a] In one aspect, there is provided use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in a subject suffering from the disease or condition associated with a telomere abnormality, wherein one or more human cells have been isolated from the subject and contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the telomere abnormality in the one or more contacted human cells.

[0020b] In one aspect, there is provided use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in a subject suffering from the disease or condition associated with a telomere abnormality, wherein one or more human cells have been contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the telomere abnormality or reduction of the disease or condition associated with the telomere abnormality when the one or more contacted human cells are introduced into the subject.

[0021] Other embodiments of the present disclosure relate to a method of treating a disease or condition associated with a chromosome abnormality, by administering to a subject in need thereof an agent that increases expression of Zscan4 in one or more human cells in the subject, where increasing expression of Zscan4 induces correction of the chromosome abnormality in the one or more human cells to treat the disease or condition associated with a chromosome abnormality.

[0021a] In one aspect, there is provided use of an agent that increases expression of Zscan4 in one or more human cells in a subject, in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in the subject, wherein increasing expression of Zscan4 induces correction of the telomere abnormality in the one or more human cells to treat the disease or condition associated with a telomere abnormality.

[0022] Other embodiments of the present disclosure relate to a method of treating a disease or condition associated with a chromosome abnormality, comprising: i. isolating one or more human cells from a subject suffering from a disease or condition associated with a chromosome abnormality; ii. contacting the one or more human cells with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the

[0024a] In one aspect, there is provided use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a karyotype abnormality in a subject suffering from the disease or condition associated with a karyotype abnormality, wherein one or more human cells have been isolated from the subject and contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the karyotype abnormality in the one or more contacted human cells.

[0025] In some embodiments that may be combined with any of the preceding embodiments, the karyotype abnormality is selected from a chromosome nullisomy, a chromosome monosomy, a chromosome trisomy, a chromosome tetrasomy, and a chromosome pentasomy. In some embodiments that may be combined with any of the preceding embodiments, the karyotype abnormality is selected from trisomy 21, trisomy 16, trisomy 18, trisomy 13, monosomy X, XXX aneuploidy, XXY aneuploidy, XYY aneuploidy, and 1p36 duplication. In some embodiments that may be combined with any of the preceding embodiments, the disease or condition associated with a karyotype abnormality is selected from dup(17)(p11.2p11.2) syndrome, Pelizaeus-Merzbacher disease, dup(22)(q11.2q11.2) syndrome, cat-eye syndrome, Cri-du-chat syndrome, Wolf-Hirschhorn, Williams-Beuren syndrome, Charcot-Marie-Tooth disease, Hereditary neuropathy with liability to pressure palsies, Smith-Magenis syndrome, Neurofibromatosis, Alagille syndrome, Velocardiofacial syndrome, DiGeorge syndrome, Steroid sulfatase deficiency, Kallmann syndrome, Microphthalmia with linear skin defects, Adrenal hypoplasia, Glycerol kinase deficiency, Pelizaeus-Merzbacher disease, Testis-determining factor on Y, Azoospermia (factor a), Azoospermia (factor b), Azoospermia (factor c), and 1p36 deletion. In some embodiments that may be combined with any of the preceding embodiments,

CLAIMS

What is claimed is:

1. Use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in a subject suffering from the disease or condition associated with a telomere abnormality, wherein one or more human cells have been isolated from the subject and contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the telomere abnormality in the one or more contacted human cells.

2. Use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in a subject suffering from the disease or condition associated with a telomere abnormality, wherein one or more human cells have been contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the telomere abnormality or reduction of the disease or condition associated with the telomere abnormality when the one or more contacted human cells are introduced into the subject.

3. Use of an agent that increases expression of Zscan4 in one or more human cells in a subject, in the manufacture of a medicament for treating a disease or condition associated with a telomere abnormality in the subject, wherein increasing expression of Zscan4 induces correction of the telomere abnormality in the one or more human cells to treat the disease or condition associated with a telomere abnormality.

4. Use of an agent that increases expression of Zscan4 in one or more human cells in a subject, in the manufacture of a medicament for treating a disease or condition associated with a karyotype abnormality in the subject, wherein increasing expression of Zscan4 induces correction of the karyotype abnormality in the one or more human cells to treat the disease or condition associated with a karyotype abnormality.

5. Use of one or more contacted human cells in the manufacture of a medicament for treating a disease or condition associated with a karyotype abnormality in a subject suffering from the disease or condition associated with a karyotype abnormality, wherein one or more human cells have been isolated from the subject and contacted with an agent that increases expression of Zscan4 in the one or more human cells, wherein increasing expression of Zscan4 induces correction of the karyotype abnormality in the one or more contacted human cells.

6. The use of claim 4 or 5, wherein the karyotype abnormality is selected from the group consisting of a chromosome nullisomy, a chromosome monosomy, a chromosome trisomy, a chromosome tetrasomy, and a chromosome pentasomy.

7. The use of claim 4 or 5, wherein the karyotype abnormality is selected from the group consisting of trisomy 21, trisomy 16, trisomy 18, trisomy 13, monosomy X, XXX aneuploidy, XXY aneuploidy, XYY aneuploidy, 1p36 duplication, dup(17)(p11.2p11.2) syndrome, Pelizaeus-Merzbacher disease, dup(22)(q11.2q11.2) syndrome, cat-eye syndrome, Cri-du-chat syndrome, Wolf-Hirschhorn, Williams-Beuren syndrome, Charcot-Marie-Tooth disease, Hereditary neuropathy with liability to pressure palsies, Smith-Magenis syndrome, Neurofibromatosis, Alagille syndrome, Velocardiofacial syndrome, DiGeorge syndrome, Steroid sulfatase deficiency, Kallmann syndrome, Microphthalmia with linear skin defects, Adrenal hypoplasia, Glycerol kinase deficiency, Testis-determining factor on Y, Azoospermia (factor a), Azoospermia (factor b), Azoospermia (factor c), and 1p36 deletion.

8. The use of any one of claims 1-3, wherein the disease or condition is a disease of telomere shortening selected from the group consisting of dyskeratosis congenita, Hoyeraal-Hreidarsson syndrome, Revesz syndrome, Coats plus syndrome, idiopathic pulmonary fibrosis, liver cirrhosis, pancreatic fibrosis, Alzheimer's disease, and osteoarthritis.

9. The use of any one of claims 1-3, wherein the disease or condition is a bone marrow failure syndrome selected from the group consisting of Fanconi anemia, amegakaryocytic thrombocytopenia, aplastic anemia, Diamond Blackfan anemia, dyskeratosis congenita, paroxysmal nocturnal hemoglobinuria (PNH), Pearson syndrome, Shwachman Diamond syndrome, thrombocytopenia, and myelodysplastic syndrome.

10. The use of any one of claims 1-3, wherein the disease or condition is an age-related telomere shortening disease or disorder, a premature aging disease or disorder, or both selected from the group consisting of Werner syndrome, Bloom's syndrome, Hutchinson-Gilford progeria syndrome, Cockayne syndrome, Xeroderma pigmentosa, Ataxia telangiectasia, Rothmund Thomson syndrome, Trichothiodystrophy, Juberg-Marsidi syndrome, and Down syndrome.

11. The use of any one of claims 1-5, wherein the one or more human cells are adult stem cells, tissue stem cells, or progenitor cells.

12. The use of any one of claims 1-5, wherein the one or more human cells are one or more adult stem cells, tissue stem cells, or progenitor cells selected from the group consisting of hematopoietic stem cells, mesenchymal stem cells, adipose stem cells, neuronal stem cells, and germ stem cells.

13. The use of any one of claims 1-5, wherein the one or more human cells are somatic cells, bone marrow cells, mature cells, or differentiated cells.

14. The use of any one of claims 1-5, wherein the one or more human cells are one or more somatic cells, bone marrow cells, mature cells, or differentiated cells selected from the group consisting of epidermal cells, fibroblasts, lymphocytes, hepatocytes, epithelial cells, myocytes, chondrocytes, osteocytes, adipocytes, cardiomyocytes, pancreatic β cells, keratinocytes, erythrocytes, peripheral blood cells, neurocytes, astrocytes, germ cells, sperm cells, and oocytes.

15. The use of any one of claims 1-5, wherein the increased expression of Zscan4 is transient.

16. The use of any one of claims 1-5, wherein the agent is an isolated nucleic acid molecule encoding Zscan4.

17. The use of claim 16, wherein the isolated nucleic acid molecule is a synthetic mRNA.

18. The use of claim 16, wherein the isolated nucleic acid molecule comprises a vector.

19. The use of claim 18, wherein the vector is a Sendai virus vector.

20. The use of claim 16, wherein the Zscan4 is a Zscan4-ERT2 fusion protein.

21. The use of claim 16, wherein the Zscan4 is a Zscan4-ΔC protein.

22. The use of any one of claims 1-5, wherein the agent is a Zscan4 protein.

23. The use of claim 22, wherein the Zscan4 protein is fused to a cell-penetrating peptide.

24. The use of claim 16 or 22, wherein the Zscan4 is a mouse Zscan4, a human ZSCAN4, or a homolog thereof.

25. The use of claim 22, wherein the Zscan4 protein is a Zscan4-ERT2 fusion protein.

26. The use of claim 22, wherein the Zscan4 protein is a Zscan4-ΔC protein.