Claims

1. An artificial nucleic acid molecule comprising

   a. at least one open reading frame (ORF);

   b. at least one 3'-untranslated region element (3'-UTR element) comprising a nucleic acid sequence which is derived from the 3'-UTR of a ribosomal protein gene or from a functional variant of the 3'-UTR of a ribosomal protein gene, wherein said functional variant is at least 80% identical to said 3'-UTR of a ribosomal protein gene; and

   c. a 5'-UTR as an additional 5'-terminal element, wherein the 5'-UTR is a 5' TOP-UTR, which does not comprise a 5'-TOP motif.

2. The artificial nucleic acid molecule according to claim 1, wherein the at least one 3'-UTR element enhances, stabilizes and/or prolongs protein production from said artificial nucleic acid molecule.

3. The artificial nucleic acid molecule according to claim 1 or 2, wherein the 3'-UTR is heterologous to the ORF.

4. The artificial nucleic acid molecule according to any one of claims 1 to 3, wherein the at least one 3'-UTR element comprises a nucleic acid sequence which is derived from the 3'-UTR of a eukaryotic ribosomal protein gene, preferably from the 3'-UTR of a vertebrate ribosomal protein gene, more preferably from the 3'-UTR of a mammalian ribosomal protein gene, even more preferably from the 3'-UTR of a primate ribosomal protein gene, in particular of a human ribosomal protein gene, or of a rodent ribosomal protein gene, in particular of a murine ribosomal protein gene.

5. The artificial nucleic acid molecule according to any one of claims 1 to 4, wherein

the open reading frame (ORF) does not encode a reporter gene or is not derived from a reporter gene, wherein the reporter gene is preferably not selected from group consisting of globin proteins (particularly beta-globin), luciferase protein, beta-glucuronidase (GUS) and GFP proteins or variants thereof, preferably not EGFP, or variants exhibiting at least 70% sequence identity to a globin protein, a luciferase protein, or a GFP protein;

the open reading frame (ORF) does not encode a ribosomal protein, preferably not an eukaryotic ribosomal protein, wherein the ribosomal protein is preferably not selected from ribosomal protein S6 (RPS6), ribosomal protein L36a-like (RPL36AL) or ribosomal protein S16 (RPS16); or

wherein the 3'-UTR is not derived from a virus.

6. The artificial nucleic acid molecule according to any one of claims 1 to 5, wherein the 3'-UTR, preferably the artificial nucleic acid molecule, does not comprise a poly(A) sequence or a polyadenylation signal,

or

wherein the 3'-UTR, preferably the artificial nucleic acid molecule, further comprises a poly(A) sequence and/or a polyadenylation signal, wherein the poly(A) sequence or the polyadenylation signal is preferably located 3'-terminal to the 3'-UTR element.

7. The artificial nucleic acid molecule according to any one of claims 1 to 6, wherein the at least one 3'-UTR element comprises a nucleic acid sequence which is derived from the 3'-UTR of a sequence selected from the group consisting of ribosomal protein L9 (RPL9), ribosomal protein L3 (RPL3), ribosomal protein L4 (RPL4), ribosomal protein L5 (RPL5), ribosomal protein L6 (RPL6), ribosomal protein L7 (RPL7), ribosomal protein L7a (RPL7A), ribosomal protein L11 (RPL11), ribosomal protein L12 (RPL12), ribosomal protein L13 (RPL13), ribosomal protein L23 (RPL23), ribosomal protein L18 (RPL18), ribosomal protein L18a (RPL18A), ribosomal protein L19 (RPL19), ribosomal protein L21 (RPL21), ribosomal protein L22 (RPL22), ribosomal protein L23a (RPL23A),

ribosomal protein L17 (RPL17), ribosomal protein L24 (RPL24), ribosomal protein L26 (RPL26), ribosomal protein L27 (RPL27), ribosomal protein L30 (RPL30), ribosomal protein L27a (RPL27A), ribosomal protein L28 (RPL28), ribosomal protein L29 (RPL29), ribosomal protein L31 (RPL31), ribosomal protein L32 (RPL32), ribosomal protein L35a (RPL35A), ribosomal protein L37 (RPL37), ribosomal protein L37a (RPL37A), ribosomal protein L38 (RPL38), ribosomal protein L39 (RPL39), ribosomal protein, large, P0 (RPLP0), ribosomal protein, large, P1 (RPLP1), ribosomal protein, large, P2 (RPLP2), ribosomal protein S3 (RPS3), ribosomal protein S3A (RPS3A), ribosomal protein S4, X- linked (RPS4X), ribosomal protein S4, Y-linked 1 (RPS4Y1), ribosomal protein S5 (RPS5), ribosomal protein S6 (RPS6), ribosomal protein S7 (RPS7), ribosomal protein S8 (RPS8), ribosomal protein S9 (RPS9), ribosomal protein S10 (RPS10), ribosomal protein S11 (RPS11), ribosomal protein S12 (RPS12), ribosomal protein S13 (RPS13), ribosomal protein S15 (RPS15), ribosomal protein S15a (RPS15A), ribosomal protein S16 (RPS16), ribosomal protein S19 (RPS19), ribosomal protein S20 (RPS20), ribosomal protein S21 (RPS21), ribosomal protein S23 (RPS23), ribosomal protein S25 (RPS25), ribosomal protein S26 (RPS26), ribosomal protein S27 (RPS27), ribosomal protein S27a (RPS27a), ribosomal protein S28 (RPS28), ribosomal protein S29 (RPS29), ribosomal protein L15 (RPL15), ribosomal protein S2 (RPS2), ribosomal protein L14 (RPL14), ribosomal protein S14 (RPS14), ribosomal protein L10 (RPL10), ribosomal protein L10a (RPL10A), ribosomal protein L35 (RPL35), ribosomal protein L13a (RPL13A), ribosomal protein L36 (RPL36), ribosomal protein L36a (RPL36A), ribosomal protein L41 (RPL41), ribosomal protein S18 (RPS18), ribosomal protein S24 (RPS24), ribosomal protein L8 (RPL8), ribosomal protein L34 (RPL34), ribosomal protein S17 (RPS17), ribosomal protein SA (RPSA), ubiquitin A-52 residue ribosomal protein fusion product 1 (UBA52), Finkel-Biskis-Reilly murine sarcoma virus (FBR-MuSV) ubiquitously expressed (FAU), ribosomal protein L22-like 1 (RPL22L1), ribosomal protein S17 (RPS17), ribosomal protein L39-like (RPL39L), ribosomal protein L10-like (RPL10L), ribosomal protein L36a-like

(RPL36AL), ribosomal protein L3-like (RPL3L), ribosomal protein S27-like (RPS27L), ribosomal protein L26-like 1 (RPL26L1), ribosomal protein L7-like 1 (RPL7L1), ribosomal protein L13a pseudogene (RPL13AP), ribosomal protein L37a pseudogene 8 (RPL37AP8), ribosomal protein S10 pseudogene 5 (RPS10P5), ribosomal protein S26 pseudogene 11 (RPS26P11), ribosomal protein L39 pseudogene 5 (RPL39P5), ribosomal protein, large, P0 pseudogene 6 (RPLP0P6) and ribosomal protein L36 pseudogene 14 (RPL36P14).

8. The artificial nucleic acid molecule according to any one of claims 1 to 7, wherein the at least one 3'-UTR element comprises or consists of a nucleic acid sequence which has an identity of at least 80%, more preferably of at least about 90%, even more preferably of at least about 95%, even more preferably of at least about 99% to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 10 to 205.

9. The artificial nucleic acid molecule according to any one of claims 1 to 8, further comprising a 5'-cap structure, a poly(C) sequence, a histone stem-loop, and/or an IRES-motif.

10. The artificial nucleic acid molecule according to any one of claims 1 to 9, wherein the histone stem-loop comprises a sequence according to SEQ ID NO: 5.

11. The artificial nucleic acid molecule according to any one of claims 1 to 10, wherein the artificial nucleic acid molecule, preferably the open reading frame, is at least partially G/C modified, preferably wherein the G/C content of the open reading frame is increased compared to the wild type open reading frame, and/or wherein the open reading frame comprises a codon-optimized region, preferably, wherein the open reading frame is codon-optimized.

12. The artificial nucleic acid molecule according to any one of claims 1 to 11, which is an RNA, preferably an mRNA molecule.

13. A vector comprising

a. an open reading frame and/or a cloning site;

b. at least one 3'-untranslated region element (3'-UTR element) comprising a nucleic acid sequence which is derived from the 3'-UTR of a ribosomal protein gene or from a functional variant of the 3'-UTR of a ribosomal protein gene, wherein said functional variant is at least 80% identical to said 3'-UTR of a ribosomal protein gene; and

c. a 5'-UTR as an additional 5'-terminal element, wherein the 5'-UTR is a 5' TOP-UTR, which does not comprise a 5'-TOP motif.

14. The vector according to claim 13, wherein the open reading frame, the at least one 3'-UTR element and/or the 5'-UTR is characterized by any one of the features as defined in any one of claims 2 to 12 with respect to the artificial nucleic acid molecule.

15. The vector according to claim 13 or 14, which is a plasmid vector or a viral vector, preferably a plasmid vector.

16. The vector according to any one of claims 13 to 15, which comprises an artificial nucleic acid molecule according to any one of claims 2-12.

17. A cell comprising the artificial nucleic acid molecule according to any one of claims 1-12 or the vector according to any one of claims 13 to 16.

18. A pharmaceutical composition comprising the artificial nucleic acid molecule according to any one of claims 1-12, the vector according to any one of claims 13 to 16, or the cell according to claim 17.

19. The pharmaceutical composition according to claim 18, further comprising one or more pharmaceutically acceptable vehicles, diluents and/or excipients and/or one or more adjuvants.

20. The artificial nucleic acid molecule according to any one of claims 1-12, the vector according to any one of claims 13 to 16, the cell according to claim 17, or the pharmaceutical composition according to claim 18 or 19 for use as a medicament.

21. The artificial nucleic acid molecule according to any one of claims 1-12, the vector according to any one of claims 13 to 16, the cell according to claim 17, or the pharmaceutical composition according to claim 18 or 19 for use as a vaccine or for use in gene therapy.

22. An *in vitro* method for enhancing, stabilizing and/or prolonging protein production from an artificial nucleic acid molecule, preferably from an mRNA molecule or a vector, the *in vitro* method comprising the step of associating the nucleic acid molecule, preferably the mRNA molecule or the vector, with an 3'-UTR element, wherein the 3'-UTR element is characterized by any one of the features as defined in any one of claims 1 to 12 with respect to the artificial nucleic acid molecule.

23. Use of an 3'-UTR element for enhancing, stabilizing and/or prolonging protein production from a nucleic acid molecule in vitro, preferably from an mRNA molecule or a vector, wherein the 3'-UTR element is characterized by any one of the features as defined in any one of claims 1 to 12 with respect to the artificial nucleic acid molecule.