Claims

1. A modified mRNA comprising at least one open reading frame and comprising at least one modification, which increases the expression of the encoded peptide or protein, wherein the at least one modification comprises a modification of the G/C content in its coding region compared to its wild-type coding region, wherein the translated amino acid sequence of the wild-type coding region is retained, for use in medical treatment, wherein the modified mRNA is to be administered by jet injection.

2. The modified mRNA for use according to claim 1, wherein the mRNA is to be administered intradermally, intramuscularly or subcutaneously.

3. The modified mRNA for use according to any of claims 1 or 2, wherein the expression of a peptide or protein encoded by the modified mRNA is increased by at least 5-fold in comparison to the same modified mRNA, which is to be administered by means other than jet injection.

4. The modified mRNA for use according to any of claims 1 to 3, wherein the modified mRNA encodes at least one antigen, a therapeutic protein or an antibody.

5. The modified mRNA for use according to any of claims 1 to 4, wherein the at least one modification further comprises a modification selected from the group consisting of codon optimization, UTR modification, Poly(A) tail with more than 30 adenosine nucleotides, Poly(C) sequence, 5'-CAP structure except of m7GpppN, histone-stem-loop sequence and a chemically modified nucleotide.

6. The modified mRNA for use according to claim 5, wherein the at least one modification is a UTR modification and the UTR is modified by introducing a UTR from a stable mRNA, wherein the stable mRNA is preferably selected from alpha-globin UTR and beta-globin UTR.

7. The modified mRNA for use according to claim 5, wherein the at least one modification is an UTR modification and the UTR is modified by introducing a 5'-UTR from a TOP gene.

8. The modified mRNA for use according to claim 5, wherein the chemically modified nucleotide is selected from pseudouridine-5'-triphosphate and 5-methylcytidine-5'-triphosphate.

9. The modified mRNA for use according to claim 5, wherein the modified mRNA comprises the following modifications: a modification of the G/C content, at least one UTR modification, a poly(A) tail with more than 30 adenosine nucleotides, and a histone stem-loop sequence.

10. The modified mRNA for use according to claim 9, wherein the histone stem-loop sequence is a nucleic acid sequence according to SEQ ID No. 44.

11. The modified mRNA for use according to claim 9 or 10, wherein the modified mRNA additionally comprises a m7GpppN 5'-CAP.

12. The modified mRNA for use according to any of claims 9 to 11, wherein the poly(A) tail comprises more than 50 adenosine nucleotides, wherein the poly(A) tail preferably consists of 64 adenosine nucleotides.

13. A pharmaceutical composition comprising a modified mRNA as defined by any one of claims 1 to 12 and comprising at least one open reading frame coding for at least one

therapeutic peptide or protein, and further comprising at least one suitable pharmaceutical excipient for use in medical treatment, wherein the pharmaceutical composition is to be administered by jet injection.

14. Use of the modified mRNA as defined according to any one of claims 1 to 12 or the pharmaceutical composition as defined according to claim 13 in the manufacture of a medicament for the treatment of prostate cancer.

15. Use of the modified mRNA as defined according to any one of claims 1 to 12 or the pharmaceutical composition as defined according to claim 13 in the manufacture of a medicament for the treatment of infectious diseases, neoplasms including cancer or tumour diseases, diseases of the blood and blood-forming organs, endocrine, nutritional and metabolic diseases, diseases of the nervous system, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, diseases of the skin and subcutaneous tissue, diseases of the musculoskeletal system and connective tissue, and diseases of the genitourinary system, wherein the modified mRNA comprises at least one modification, which increases the expression of the encoded peptide or protein, and comprises at least one open reading frame coding for said peptide or protein, wherein said at least one modification is a modification of the G/C content in its coding region compared to its wild-type coding region, wherein the amino acid sequence of the wild-type coding

region is retained and wherein the method comprises administration of the modified mRNA by jet injection.

16. Use of the modified mRNA according to claim 15, wherein the mRNA-encoded protein is an antigen, therapeutic protein or an antibody.

17. A kit of parts comprising a modified mRNA as defined by any of claims 1 to 12 in the manufacture of a medicament for the treatment of prostate cancer, wherein the modified mRNA is to be administered by jet injection.

18. A kit of parts comprising a modified mRNA as defined by any of claims 1 to 12 in the manufacture of a medicament for the treatment of infectious diseases, neoplasms including cancer or tumour diseases, diseases of the blood and blood-forming organs, endocrine, nutritional and metabolic diseases, diseases of the nervous system, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, diseases of the skin and subcutaneous tissue, diseases of the musculoskeletal system and connective tissue, and diseases of the genitourinary system, wherein the modified mRNA comprises at least one modification, which increases the expression of the encoded peptide or protein, and comprises at least one open reading frame coding for said peptide or protein, wherein said at least one modification is a modification of the G/C content in its coding region compared to its wild-type coding region, wherein the amino acid sequence of the wild-type coding region is retained and wherein the modified mRNA is to be administered by jet injection.

19. The kit for use according to claims 17 and 18, further comprising instructions for use, an adjuvant, wherein the pharmaceutical composition is to be administered, a pharmaceutically acceptable carrier and/or a pharmaceutically acceptable solution for dissolution or dilution of the modified mRNA or the pharmaceutical composition.