SUMMARY

[0009a] In one aspect, there is provided a recombinant polypeptide comprising the amino acid sequence of full-length human type 21 alpha 1 collagen having a truncation of from 50 amino acids to 800 amino acids, wherein the truncation comprises a truncation at the N-terminal end and a truncation at the C-terminal end of the full-length human type 21 alpha 1 collagen, wherein the recombinant polypeptide comprises the amino acid sequence according to SEQ ID NO: 76, and wherein the recombinant polypeptide is monomeric ~~and does not form a stable triple helix structure of natural collagen~~.

[0009b] In another aspect, there is provided a recombinant cell comprising at least one copy of a heterologous nucleic acid sequence encoding a recombinant polypeptide as described herein.

[0009c] In another aspect, there is provided a composition comprising ~~from~~between 0.005% w/w and~~to~~ 30% w/w of the recombinant polypeptide as described herein.

[0010] In one example, a non-naturally occurring collagen produced by a host cell is provided. The non-naturally occurring collagen is jellyfish (Hydrozoan) collagen, human collagen, Chondrosia reniformis (kidney sponge) collagen, or Rhincodon typus (whale shark) collagen. In an embodiment, the non-naturally occurring collagen is a full-length or a truncated collagen. In one embodiment, the collagen is truncated by an internal truncation of between 50 amino acids and 500 amino acids. In another embodiment, the truncation is at the C-terminal end or the N-terminal end of the collagen polypeptide. The non-naturally occurring collagens are SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 74, SEQ ID NO: 76, SEQ ID NO: 78, SEQ ID NO: 80, SEQ ID NO: 82, SEQ TD NO: 84, SEQ ID NO: 86, SEQ ID NO: 89 SEQ ID NO: 91, SEQ ID NO: 92, SEQ ID NO: 94, SEQ ID NO: 96, SEQ ID NO: 102, SEQ ID NO: 104, SEQ ID NO: 106, SEQ ID NO: 108, SEQ ID NO: 110, or SEQ ID NO: 112.

[0011] In another example, the non-naturally occurring collagen further comprises amino acid sequences including a secretion tag, a histidine tag, a green fluorescent protein tag, a protease cleavage site, a Beta-lactamase and/or GEK amino acid trimer repeats and/or GDK amino acid trimer repeats. When the non-naturally occurring collagen comprises one or more amino acid trimer repeats of the sequence glycine-glutamic acid-lysine (GEK) and/or glycine-aspartic acid-lysine (GDK), the number of GEK and/or GDK trimer repeats can range from 2 to 50 trimer repeats. In one example, the secretion tag is DsbA, PelB, OmpA, TolB, MalE, lpp, TorA, or HylA, or a hybrid secretion tag that comprises a portion of one secretion tag fused to a portion of a second secretion tag. An exemplary secretion tag is DsbA.

[0012] In one example, provided are compositions that comprise between 0.005% and 30% w/w non-naturally occurring collagen. The compositions can further comprise at least one additional ingredient comprising a topical carrier or a preservative

What is claimed is:

1. A recombinant polypeptide comprising the amino acid sequence of full-length human type 21 alpha 1 collagen having a truncation of from 50 amino acids to 800 amino acids, wherein the truncation comprises a truncation at the N-terminal end and a truncation at the C-terminal end of the full-length human type 21 alpha 1 collagen, wherein the recombinant polypeptide comprises the amino acid sequence according to SEQ ID NO: 76, and wherein the recombinant polypeptide is monomeric ~~and does not form a stable triple helix structure of natural collagen~~.

2. The recombinant polypeptide of claim 1, wherein the truncation further comprises an internal truncation of the full-length human type 21 alpha 1 collagen.

3. The recombinant polypeptide of claims 1 or 2, wherein the truncation comprises a truncation at the N-terminal end of the full-length human type 21 alpha 1 collagen of from 50 amino acids to 600 amino acids.

4. The recombinant polypeptide of any one of claims 1-3, wherein the truncation comprises a truncation at the C-terminal end of from 50 amino acids to 250 amino acids.

5. The recombinant polypeptide of claim 1, wherein the recombinant polypeptide consists of the amino acid sequence according to SEQ ID NO: 76.

6. The recombinant polypeptide of any one of claims 1-~~5~~4, further comprising one or more selected from the group consisting of: a secretion tag; a fluorescent protein; a protease cleavage site; and a beta-lactamase protein.

7. The recombinant polypeptide of claim 6, wherein the secretion tag is DsbA.

8. A recombinant cell comprising at least one copy of a heterologous nucleic acid sequence encoding a recombinant polypeptide according to any one of claims 1-7.

9. The recombinant cell of claim 8, wherein the recombinant cell is a bacterial cell.

10. The recombinant cell of claim 9, wherein the bacterial cell is *Escherichia coli*.

11. The recombinant cell of any one of claims 8-10, wherein the heterologous nucleic acid sequence comprises SEQ ID NO: 75.

12. The recombinant cell of any one of claims 8-11, wherein the heterologous nucleic acid sequence is codon-optimized for expression in a cell.

13. The recombinant cell of any one of claims 8-12, wherein the recombinant cell is capable of secreting the recombinant polypeptide extracellularly.

14. A composition comprising ~~from~~ between 0.005% w/w and~~to~~ 30% w/w of the recombinant polypeptide of any one of claims 1-7.

15. The composition of claim 14, wherein the composition is formulated for topical application.

16. The composition of claim 14 or 15, wherein the composition comprises a topical carrier, a preservative, or both.

17. The composition of any one of claims 14-16, wherein the composition is a cosmetic.