CLAIMS

WHAT IS CLAIMED IS:

1. A plant cell, wherein the plant cell comprises:

a vector comprising:

(i) a polynucleotide sequence encoding for a heterologous protease inhibitor ~~gene~~ or a functional variant thereof; and

(ii) a polynucleotide sequence encoding for a mammalian ~~gene~~ protein or a functional variant thereof~~.~~,

wherein the mammalian protein is a mammalian growth factor protein selected from the group consisting of mammalian fibroblast growth factor 2 (FGF-2), mammalian insulin-like growth factor 1 (IGF-1), and mammalian vascular endothelial growth factor (VEGF).

2. The plant cell of claim 1, wherein the ~~polynucleotide sequence encoding for a~~ heterologous protease inhibitor is SICYS8 ~~gene or a functional variant thereof and the polynucleotide sequence encoding for a mammalian gene or a functional variant thereof are within a bacterial or viral vector~~.

3. The plant cell of claim ~~2~~1, wherein the ~~bacterial~~ vector is ~~an Agrobacterium species.~~:

(i) a viral vector; or

(ii) a bacterial vector.

4. The plant cell of claim ~~2~~1, wherein the ~~viral~~ vector is Tobacco mosaic virus.

5. The plant cell of claim 1, wherein the vector is an *Agrobacterium* species ~~mammalian gene is selected from the group consisting of TGF β, IGF-1, IGF-2, human FGF-2, Activin A, BMP-4 and VEGF~~.

6. The plant cell of claim 1, wherein the plant cell is a tobacco plant cell ~~heterologous protease inhibitor gene is SICYS8~~.

7. The plant cell of claim ~~1~~6, wherein the tobacco plant cell is an *Nicotiana benthamiana* cell ~~polynucleotide sequence encoding for a heterologous protease inhibitor gene or a functional variant thereof and polynucleotide sequence encoding for a mammalian gene or a functional variant thereof are RNA or DNA~~.

8. ~~A plant cell~~The plant cell of claim 1, wherein the mammalian protein is the mammalian FGF-2, and wherein the mammalian FGF-2 is human FGF-2 or bovine FGF-2 ~~plant cell comprises:~~

~~a polynucleotide sequence encoding for a chicken FGF-2 gene or a functional variant thereof~~.

9. The plant cell of claim 8, wherein the polynucleotide sequence encoding for the human FGF-2 comprises a sequence with at least 75% sequence identity to SEQ ID NOs: 23, 24, 25, 26, or 28 ~~is within a bacterial or viral vector~~.

10. The plant cell of claim 8, wherein the human FGF-2 comprises a polypeptide sequence selected from the group consisting of SEQ ID NOs: 1, 2, 3, 4, 5, 6, and 14.

11. The plant cell of claim 8, wherein the bovine FGF-2 comprises a polypeptide sequence of SEQ ID NO: 15.

12. The plant cell of claim 1, wherein the mammalian protein is mammalian IGF-1.

13. The plant cell of claim 12, wherein the mammalian IGF-1 comprises a polypeptide sequence of SEQ ID NO: 12 or SEQ ID NO: 13.

14. The plant cell of claim 1, wherein the mammalian protein is mammalian VEGF.

15. The plant cell of claim 1, wherein the mammalian VEGF comprises a polypeptide sequence of SEQ ID NO: 20.

~~10. The plant cell of claim 9, wherein the polynucleotide sequence comprises a sequence with at least 75% sequence identity to SEQ ID NO: 21.~~

~~11. The plant cell of claim 8, wherein the functional variant comprises an insertion, deletion, or sequence variation compared to the full-length sequence.~~

~~12. The plant cell of claim 9, wherein the bacterial vector comprises a Agrobacterium species.~~

~~13. The plant cell of claim 8, wherein the viral vector is Tobacco mosaic virus.~~

~~14. The plant cell of claim 8, wherein the polynucleotide sequence is RNA or DNA.~~

~~15. A plant cell, wherein the plant cell comprises:~~

~~a polynucleotide sequence encoding for a IL-1β gene or a functional variant thereof.~~

~~16. The plant cell of claim 15, wherein the polynucleotide sequence is within a bacterial or viral vector.~~

~~17. The plant cell of claim 8, wherein the polynucleotide sequence comprises a sequence with at least 75% sequence identity to SEQ ID NO: 27.~~

~~18. The plant cell of claim 8, wherein the functional variant comprises an insertion, deletion, or sequence variation compared to the full-length sequence.~~

~~19. The plant cell of claim 16, wherein the bacterial vector comprises a Agrobacterium species.~~

20. The plant cell of claim 16, wherein the viral vector is Tobacco mosaic virus.

21. A plant cell, wherein the plant cell comprises:

a heterologous protease inhibitor protein or a functional variant thereof; and a mammalian protein or a functional variant thereof.

22. The plant cell of claim 21, further comprising a bacterial or viral vector.

23. The plant cell of claim 22, wherein the bacterial vector is an Agrobacterium species.

24. The plant cell of claim 22 wherein the viral vector is Tobacco Mosaic Virus.

25. The plant cell of claim 21, wherein the mammalian protein is from the group consisting of TGF-β , IGF-1, IGF-2, human FGF-2, Activin A, BMP-4 and VEGF.

26. A plant cell, wherein the plant cell comprises:

a chicken FGF-2 protein or a functional variant thereof.

27. The plant cell of claim 26, where the chicken FGF-2 protein comprises a sequence with at least 75% sequence identity to SEQ ID NO: 8.

28. The plant cell of claim 26, wherein the functional variant comprises an insertion, deletion, or sequence variation compared to the full-length sequence.

29. The plant cell of claim 26, further comprising a bacterial of viral vector.

30. The plant cell of claim 29, wherein the bacterial vector comprises a Agrobacterium species.

31. The plant cell of claim 29, wherein the viral vector is Tobacco mosaic virus.

32. A plant cell, wherein the plant cell comprises:

a IL1$-\beta$ protein or a functional variant thereof.

33. The plant cell of claim 32, where the IL1$-\beta$ protein comprises a sequence with at least 75% sequence identity to SEQ ID NOs: 9.

34. The plant cell of claim 32, wherein the functional variant comprises an insertion, deletion, or sequence variation compared to the full-length sequence.

35. The plant cell of claim 32, further comprising a bacterial of viral vector.

36. The plant cell of claim 35, wherein the bacterial vector comprises a Agrobacterium species.

37. The plant cell of claim 35, wherein the viral vector is Tobacco mosaic virus.

38. A composition, wherein the composition comprises:

a mammalian protein or a functional variant thereof; and

~~at least one of the following: flavonoids, rubisco, plant-derived alkaloids, cellulose, lignocellulose, legumalin, phaselin, 11S legumin type, 7s vicilin type, gliadin, zein, hordein, secalin, and glutenins.~~

~~39. The composition of claim 36, wherein the mammalian protein is at least one of TGF-β , IGF-1, IGF-2, human FGF-2, Activin A, BMP-4 and VEGF.~~

~~40. The composition of claim 38, wherein the at least one of the following comprises no more than 0.05% of the composition.~~

~~41. The composition of claim 39, wherein the at least one of the following comprises no more than 0.03% of the composition.~~

~~42. The composition of claim 38, further comprising heparin.~~

~~43. The composition of claim 42, wherein heparin is present at no more than 2 μg/ml.~~

~~44. A composition, wherein the composition comprises:~~

~~a chicken FGF-2 protein or a functional variant thereof; and~~

~~at least one of the following: flavonoids, rubisco, plant-derived alkaloids, cellulose, lignocellulose, legumalin, phaselin, 11S legumin type, 7s vicilin type, gliadin, zein, hordein, secalin, and glutenins.~~

~~45. The composition of claim 44, wherein the at least one of the following comprises no more than 0.05% of the composition.~~

~~46. The composition of claim 45, wherein the at least one of the following comprises no more than 0.03% of the composition.~~

~~47. The composition of claim 44, further comprising heparin.~~

~~48. The composition of claim 47, wherein heparin is present at no more than 2 μg/ml~~

~~49. A composition, wherein the composition comprises:~~

~~a human interleukin 1 beta (IL1-β) protein or a functional variant thereof and~~

~~at least one of the following: flavonoids, rubisco, plant-derived alkaloids, cellulose, lignocellulose, legumalin, phaselin, 11S legumin type, 7s vicilin type, gliadin, zein, hordein, secalin, and glutenins.~~

~~50. The composition of claim 49, wherein the at least one of the following comprises no more than 0.05% of the composition.~~

~~51. The composition of claim 49, wherein the at least one of the following comprises no more than 0.03% of the composition.~~

~~52~~16. A method of manufacturing a mammalian protein, comprising:

~~(i)~~ culturing ~~the~~ a plurality of plant cells ~~of any of claims 1-20; and~~, each of the plurality of plant cells comprising a vector comprising:

(a) a polynucleotide sequence encoding for a heterologous protease inhibitor or a functional variant thereof, and

(b) a polynucleotide sequence encoding for a mammalian protein or a functional variant thereof; and

~~(ii)~~ extracting soluble proteins from a harvested plurality of plant cells, thereby generating ~~a mammalian protein encoded by the mammalian gene or the functional variant thereof to generate~~ an extraction product comprising the mammalian protein or a functional variant thereof, wherein the mammalian protein is a mammalian growth factor protein selected from the group consisting of mammalian fibroblast growth factor 2 (FGF-2), mammalian insulin-like growth factor 1 (IGF-1), and mammalian vascular endothelial growth factor (VEGF).

17. The method of claim 16, further comprising: prior to and/or during (i), infiltrating the vector into another plurality of plant cells, thereby forming the plurality of plant cells.

18. The method of claim 17, wherein the infiltrating is vacuum infiltrating.

19. The method of claim 16, wherein the mammalian protein is human FGF-2, bovine FGF-2, bovine IGF-1, or human VEGF.

20. The method of claim 16, wherein the mammalian protein is histidine-tagged, and wherein the extracting comprises using metal-based histidine-tag affinity (NTA) magnetic beads.

~~53. The method of claim 52, wherein the extraction product comprises the mammalian protein present in an amount of at least 40 μg per gram of biomass.~~

~~54. The method of claim 53, wherein the mammalian protein is present in an amount of at least 45, 50, 55 μg per gram of biomass.~~

~~55. The method of claim 52, wherein the culturing comprises contacting a bacterial or viral vector to the plant cell using a syringe or spray method.~~

~~56. A method of manufacturing a mammalian protein, comprising:~~

~~culturing the plant cells of any of claims 21-37; and~~

~~extracting the mammalian protein or the functional variant thereof to generate an extraction product.~~

~~57. The method of claim 56, wherein the extraction product comprises the mammalian protein present in an amount of at least at least 40 μg per gram of biomass.~~

58. The method of claim 57, wherein the mammalian protein is present in an amount of at least 45, 50, 55 μg per gram of biomass.

59. The method of claim 56, wherein the culturing comprises contacting a bacterial or viral vector to the plant cell using a syringe or spray method.

60. A plant cell comprising a polynucleotide sequence encoding for a mammalian gene or a functional variant thereof, wherein the mammalian gene is selected from the group consisting of TGF-β, IGF-1, IGF-2, FGF-2, BMP-4, and VEGF, and wherein the plant cell is not derived from Oryza sativa.

61. The plant cell of claim 60, wherein the polynucleotide sequence encoding for a mammalian gene or a functional variant thereof are within a bacterial or viral vector.

62. The plant cell of claim 61, wherein the bacterial vector comprises an Agrobacterium species.

63. The plant cell of claim 61, wherein the viral vector comprises a Tobacco mosaic virus.

64. The plant cell of any one of claims 60-63, wherein the polynucleotide sequence encoding for a mammalian gene or a functional variant thereof is RNA or DNA.

65. The plant cell of any one of claims 60-64, wherein the functional variant comprises an insertion, a deletion, or a sequence variation compared to the mammalian gene.

66. A plant cell, wherein the plant cell comprises a mammalian protein or a functional variant thereof, and wherein the plant cell is not derived from Oryza sativa.

67. The plant cell of claim 66, further comprising a bacterial or viral vector.

68. The plant cell of claim 67, wherein the bacterial vector comprises an Agrobacterium species.

69. The plant cell of claim 67, wherein the viral vector comprises a Tobacco Mosaic Virus.

70. A method of manufacturing a mammalian protein, comprising:

culturing the plant cells of any of claims 60-65; and

extracting a mammalian protein encoded by the mammalian gene or the functional variant thereof to generate an extraction product.

71. The method of claim 70, wherein the extraction product comprises the mammalian protein present in an amount of at least 40 μg per gram of biomass.

72. The method of claim 71, wherein the mammalian protein is present in an amount of at least 45, 50, 55 μg per gram of biomass.

73. The method of any one of claims 70-72, wherein the culturing comprises contacting a bacterial or viral vector to the plant cell using a syringe or spray method.

~~74. A method of manufacturing a mammalian protein, comprising:~~

~~culturing the plant cells of any of claims 66-69; and~~

~~extracting the mammalian protein or the functional variant thereof to generate an extraction product.~~

~~75. The method of claim 74, wherein the extraction product comprises the mammalian protein present in an amount of at least at least 40 μg per gram of biomass.~~

~~76. The method of claim 75, wherein the mammalian protein is present in an amount of at least 45, 50, 55 μg per gram of biomass.~~

~~77. The method of any one of claims 74-76, wherein the culturing comprises contacting a bacterial or viral vector to the plant cell using a syringe or spray method.~~