CLAIMS

We claim:

1. A serum-free cell culture media for expansion of cells, the media comprising:

   a basal culture media; and

   a plant protein composition at a final concentration of 0.05 g/L to 50 g/L in the serum-free cell culture media,

   wherein the plant protein composition comprises unhydrolyzed plant proteins, and

   wherein the serum-free cell culture media is free or substantially free of albumin.

2. A serum-free cell culture media for expansion of cells, the media comprising:

   a basal culture media; and

   a plant protein composition at a final concentration of 0.05 g/L to 1 g/L in the serum-free cell culture media,

   wherein the plant protein composition comprises a majority of plant proteins that are 3 kDa or greater in size,

   wherein the serum-free cell culture media is free or substantially free of albumin.

3. The serum-free cell culture media of claim 1 or 2, wherein the plant protein composition was not treated with a hydrolytic enzyme.

4. The serum-free cell culture media of claim 2 or 3, wherein at least about 70% or 75% of the plant proteins are 10 kDa or greater in size.

5. The serum-free cell culture media of any one of the preceding claims, wherein the plant protein composition comprises protein from a plant selected from the group consisting of oilseed crops, non-oilseed oil crops, legumes, pulses, and combinations thereof.

6. The serum-free cell culture media of claim 5, wherein the plant protein composition comprises protein from an oilseed crop.

7. The serum-free cell culture media of any one of claims 1-4, wherein the plant protein composition comprises protein from rapeseed, soybean, sunflower seed, sesame seed, flax seed, camelina, safflower, linseed, grapeseed, pumpkin seed, poppyseed, watermelon seed, and combinations thereof.

8. The serum-free cell culture media of claim 1 or 2, wherein the plant protein composition comprises protein from rapeseed.

9. The serum-free cell culture media of claim 5, wherein the plant protein composition comprises protein from a non-oilseed oil crop.
10. The serum-free cell culture media of claim 9, wherein the plant protein composition comprises protein from palm kernel, coconut, olive, corn, hemp, almond, cashew, and combinations thereof.
11. The serum-free cell culture media of claim 10, wherein the plant protein composition comprises protein from pea, chickpea, fava bean, lentil, lupin, lima bean, mung bean, navy bean, Bambara bean, mesquite bean, mucuna bean, pigeon pea, potato bean, yam bean, and combinations thereof.
12. The serum-free cell culture media of any one of the preceding claims, wherein the basal culture media comprises:

    one or more sugars at a concentration of between 0.01 g/L and 10 g/L;

    one or more amino acids at a concentration of between 0.001 g/L and 5 g/L;

    one or more vitamins at a concentration of between 0.001 g/L and 1 g/L;

    one or more trace elements at a concentration of between 0.0001 mg/L and 10 mg/L;

    one or more growth-stimulating and/or cell-signaling factors at a concentration of between 0 ng/mL and 100,000 ng/mL; and

    one or more transport proteins at a concentration of between 0 g/L and 1 g/L.
13. The serum-free cell culture media of any one of the preceding claims, further comprising one or more of the following:

    recombinant interleukin 6;

    ethanolamine;

    curcumin;

    oleic acid;

    minerals;

    hepatocyte growth factor (HGF);

    insulin-like growth factor 1 (IGF-1);

    platelet-derived growth factor BB (PDGF-BB); and/or

    linoleic acid.
14. The serum-free cell culture media of claim 13, comprising minerals at a concentration of between 0 g/L and 15 g/L.

15. The serum-free cell culture media of any one of the preceding claims, wherein the plant protein composition is present at a concentration of at least 50 mg/L, at least 100 mg/L, at least 200 mg/L, at least 250 mg/L, at least 500 mg/L, at least 750 mg/L, at least 1 g/L, or at most 50 g/L, at most 25 g/L, at most 15 g/L, at most 10 g/L, at most 5 g/L, at most 2 g/L, at most 1.5 g/L, and at most 1 g/L or any range between these concentrations.
16. The serum-free cell culture media of any one of the preceding claims, wherein the plant protein composition is present at a concentration of about 200 mg/L to about 400 mg/L.
17. The serum-free cell culture media of any one of the preceding claims, further comprising a recombinant version of interleukin 6.
18. The serum-free cell culture media of any one of the preceding claims, further comprising ethanolamine.
19. The serum-free cell culture media of any one of the preceding claims, further comprising curcumin.
20. The serum-free cell culture media of any one of the preceding claims, further comprising oleic acid.
21. The serum-free cell culture media of any one of the preceding claims, further comprising linoleic acid.
22. The serum-free cell culture media of any one of the preceding claims, wherein the basal culture media is B8 media.
23. The serum-free cell culture media of any one of the preceding claims, wherein the basal culture media is selected from the group comprising Dulbecco's Modified Eagle Medium (DMEM), Ham's F12 media, Roswell Park Memorial Institute (RPMI) 1640 media, Leibovitz's L15 and a mixture thereof.
24. The serum-free cell culture media of any one of the preceding claims, further comprising 2-Phospho-L-ascorbic acid trisodium salt, insulin, Transferrin, sodium selenite, fibroblast growth factor 2, Neregulin 1, transforming growth factor beta 3, and/or mixtures thereof.
25. The serum-free cell culture media of claim 24, wherein insulin, fibroblast growth factor 2, Neregulin 1, and transforming growth factor beta 3 are present at concentrations less than or equal to 10 μg/mL, 20 ng/mL, 0.1 ng/mL, and 0.1 ng/mL, respectively.
26. The serum-free cell culture media of any one of the preceding claims, wherein albumin is present in an amount equal to or less than 0.1g/L.

27. The serum-free cell culture media of any one of the preceding claims, wherein the serum-free cell culture media contains no animal-derived components.
28. The serum-free cell culture media of any one of the preceding claims, wherein the serum-free cell culture media includes recombinantly derived animal proteins.
29. The serum-free cell culture media of any one of the preceding claims, wherein the serum-free cell culture media is food-grade.
30. A method of making a serum-free cell culture media, the method comprising adding a plant protein composition at a final concentration of 0.05 g/L to 50 g/L in the serum-free cell culture media to a basal culture media, thereby producing the serum-free cell culture media.
31. The method of claim 30, wherein the serum-free cell culture media, the plant protein composition, and the basal culture media are as defined in any one of claims 1 to 29.
32. The method of claim 30 or 31, wherein the plant protein composition was prepared by alkali extraction followed by acid precipitation from an aqueous solution of a ground plant material.
33. The method of claim 32, wherein the ground plant material is defatted or partially defatted prior to preparation of the plant protein composition.

34. A method of expanding the numbers of or differentiating cells, the method comprising: adding cells to a serum-free cell culture media, incubating the cells in the serum-free cell culture media to allow expansion of the number of or differentiation of cells and production of growth media; and harvesting the cells and/or growth media, wherein the serum-free cell culture media comprises:

    a basal culture media; and

    a plant protein composition at a final concentration of 0.05 g/L to 50 g/L in the serum-free cell culture media,

    wherein the plant protein composition comprises unhydrolyzed plant proteins, and

    wherein the serum-free cell culture media is free or substantially free of albumin.

35. A method of expanding the numbers of or differentiating cells, the method comprising: adding cells to a serum-free cell culture media, incubating the cells in the serum-free cell culture media to allow expansion of the number of or differentiation of cells and production

of growth media; and harvesting the cells and/or growth media, wherein the serum-free cell culture media comprises:

a basal culture media; and

a plant protein composition at a final concentration of 0.05 g/L to 50 g/L in the serum-free cell culture media,

wherein the plant protein composition comprises a majority of plant proteins that are 3 kDa or greater in size, and

wherein the serum-free cell culture media is free or substantially free of albumin.

36. The method of claim 35, wherein at least about 74% of the plant proteins are 10 kDa or greater in size.

37. The method of any one of claims 34-36, wherein the cells are selected from the group consisting of bovine, galline, ovine, porcine, equine, murine, caprine, lapine, and piscine.

38. The method of claim 37, wherein the cells are bovine cells.

39. The method of claim 37, wherein the cells are piscine cells.

40. The method of any one of claims 34-39, wherein the cells are selected from the group comprising muscle satellite cells, fibroblasts, adipogenic precursor cells, mesenchymal stem cells, embryonic stem cells, and induced pluripotent stem cells.

41. The method of claim 40, wherein the cells are muscle satellite cells.

42. The method of claim 41, wherein the muscle satellite cells are primary cells or cells that have been immortalized through genetic modification or spontaneous immortalization.

43. The method of any one of claims 34-36, wherein the cells are bovine muscle satellite cells.

44. The method of any one of claims 34-36, wherein the cells are piscine muscle satellite cells.

45. The method of any one of claims 34 to 44, the method further comprising:
prior to adding the cells, either: i) coating a cell culture substrate or the cells with a cell adhesive peptide; or ii) adhering the cells to the cell culture substrate in the basal culture media and/or a different basal culture media that is lacking the plant protein composition.

46. The method of claim 45, the method comprising the coating of step i) and the adhering of step ii).

47. The method of claim 45 or 46, wherein the cell adhesive peptide is selected from the group consisting of laminin or fragments thereof, vitronectin or fragments thereof, poly-d-lysine, poly-l-lysine, fibronectin or fragments thereof, solubilized basement membrane or extracellular matrix preparation (Matrigel), and combinations thereof.

48. The method of claim 47, wherein the cell adhesive peptide is generated recombinantly and not derived from an animal.

49. The method of any one of claims 34 to 48, wherein the cells are genetically engineered cells.

50. The method of any one of claims 34 to 49, wherein the cells expand more when incubated in the serum-free cell culture media than control cells incubated in the basal culture media without the plant protein composition.

51. The method of claim 50, wherein the cells expand at least 50% more when incubated in the serum-free cell culture media than control cells incubated in the basal culture media without the plant protein composition.

52. The method of any one of claims 34 to 51, further comprising using the harvested cells in a cultured food product.

53. The method of any one of claims 34 to 52, further comprising using the growth media to produce a food or pharmaceutical product.

54. The method of any one of claims 34 to 53, wherein the plant protein composition was not treated with a hydrolytic enzyme.

55. The method of any one of claims 34 to 54, wherein the plant protein composition is from a plant selected from the group consisting of oilseed crops, non-oilseed oil crops, legumes, pulses, and combinations thereof.

56. The method of claim 55, wherein the plant protein composition is from an oilseed crop.

57. The method of any one of claims 34 to 54, wherein the plant protein composition is from rapeseed, soybean, sunflower seed, sesame seed, flax seed, camelina, safflower, linseed, grapeseed, pumpkin seed, poppyseed, watermelon seed, and combinations thereof.

58. The method of any one of claims 34 to 57, wherein the plant protein composition is from rapeseed.

59. The method of claim 55, wherein the plant protein composition is from a non-oilseed oil crop.

60. The method of claim 59, wherein the plant protein composition is from palm kernel, coconut, olive, corn, hemp, almond, cashew, and combinations thereof.

61. The method of claim 55, wherein the plant protein composition is from pea, chickpea, fava bean, lentil, lupin, lima bean, mung bean, navy bean, Bambara bean, mesquite bean, mucuna bean, pigeon pea, potato bean, yam bean, and combinations thereof.

62. The method of any one of claims 34 to 61, wherein the basal culture media comprises:
one or more sugars at a concentration of between 0.01 g/L and 10 g/L;

one or more amino acids at a concentration of between 0.001 g/L and 5 g/L;
one or more vitamins at a concentration of between 0.001 g/L and 1 g/L;
one or more trace elements at a concentration of between 0.0001 mg/L and 10 mg/L;
one or more growth-stimulating and/or cell-signaling factors at a concentration of between 0 ng/mL and 100,000 ng/mL; and
one or more transport proteins at a concentration of between 0 g/L and 1 g/L.

63. The method of any one of claims 34 to 62, wherein the serum-free cell culture media further comprises one or more of the following:
recombinant interleukin 6;
ethanolamine;
curcumin;
oleic acid;
minerals;
hepatocyte growth factor (HGF);
insulin-like growth factor 1 (IGF-1);
platelet-derived growth factor BB (PDGF-BB); and/or
linoleic acid.

64. The method of claim 63, wherein the serum-free cell culture media comprises minerals at a concentration of between 0 g/L and 15 g/L.

65. The method of any one of claims 34 to 64, wherein the plant protein composition is present at a concentration of at least 50 mg/L, at least 100 mg/L, at least 200 mg/L, at least 250 mg/L, at least 500 mg/L, at least 750 mg/L, at least 1 g/L, or at most 50 g/L, at most 25 g/L, at most 15 g/L, at most 10 g/L, at most 5 g/L, at most 2 g/L, at most 1.5 g/L, and at most 1 g/L.

66. The method of any one of claims 34 to 65, wherein the plant protein composition is present at a concentration of about 200 mg/L to about 400 mg/L.

67. The method of any one of claims 34 to 66, wherein the serum-free cell culture media further comprises a recombinant version of interleukin 6.

68. The method of any one of claims 34 to 67, wherein the serum-free cell culture media further comprises ethanolamine.

69. The method of any one of claims 34 to 68, wherein the serum-free cell culture media further comprises curcumin.

70. The method of any one of claims 34 to 69, wherein the serum-free cell culture media further comprises oleic acid.

71. The method of any one of claims 34 to 70, wherein the serum-free cell culture media further comprises linoleic acid.

72. The method of any one of claims 34 to 71, wherein the basal culture media is B8 media.

73. The method of any one of claims 34 to 71, wherein the basal culture media is selected from the group comprising Dulbecco's Modified Eagle Medium (DMEM), F12, and a mixture thereof.

74. The method of any one of claims 34 to 73, wherein the serum-free cell culture media further comprises 2-Phospho-L-ascorbic acid trisodium salt, insulin, Transferrin, sodium selenite, fibroblast growth factor 2, Neregulin 1, transforming growth factor beta 3, and/or mixtures thereof.

75. The method of claim 74, wherein insulin, fibroblast growth factor 2, Neregulin 1, and transforming growth factor beta 3 are present in the serum-free cell culture media at concentrations less than or equal to 10 μg/mL, 20 ng/mL, 0.1 ng/mL, and 0.1 ng/mL, respectively.

76. The method of any one of claims 34 to 75, wherein albumin is present in the serum-free cell culture media in an amount equal to or less than 0.1g/L.

77. The method of any one of claims 34 to 76, wherein the serum-free cell culture media contains no animal-derived components.

78. The method of any one of claims 34 to 77, wherein the serum-free cell culture media includes recombinantly derived animal proteins.

79. The method of any one of claims 34 to 78, wherein the serum-free cell culture media is food-grade.

80. The method of any one of claims 34 to 79, wherein the plant protein composition was prepared by alkali extraction followed by acid precipitation of an aqueous solution from a ground plant material.

81. The method of claim 80, wherein the ground plant material is defatted or partially defatted.