WHAT IS CLAIMED

1. A method of producing an avian fibroblast cell food product *in-vitro,* the method comprising the steps of:
    a. culturing a population of avian fibroblast cells *in vitro* in a growth medium capable of maintaining the avian fibroblast cells;
    b. recovering the avian fibroblast cells; and
    c. formulating the recovered avian fibroblast cells into an edible food product.
2. The method of claim 1, wherein the growth medium comprises at least 10% fetal bovine serum.
3. The method of claim 1, comprising growing the population of avian fibroblast cells in a medium with at least 10% fetal bovine serum, followed by reducing the medium to less than 2% fetal bovine serum before recovering the cells.
4. The method of claim 3, wherein fetal bovine serum is reduced to 0% before recovering the cells.
5. The method of any of the preceding claims, further comprising modifying the growth medium to optimize the expression of at least one gene from a cell signaling pathway selected from the group consisting of proteasome, steroid biosynthesis, amino acid degradation, amino acid biosynthesis, drug metabolism, focal adhesion, cell cycle, MAPK signaling, glutathione metabolism, TGF-beta, phagosome, terpenoid biosynthesis, DNA replication, glycolysis, gluconeogenesis, protein export, butanoate metabolism, and synthesis and degradation of ketone bodies.
6. The method of any of the preceding claims, further comprising monitoring wherein the stages of producing avian fibroblast for gene expression of cell signaling pathways.
7. The method of any of preceding claims, further comprising adjusting the medium at each stage of cell production in accordance with data obtained from the monitoring of gene expression.
8. The method of any of the above claims, wherein the population of avian fibroblast cells is substantially pure.
9. The method of the preceding claims, further comprising inducing avian fibroblast cells to accumulate lipids by adding or removing one or more compounds to or from

the growth media in quantities sufficient to induce the accumulation of one or more lipids.

10. The method of any of the preceding claims, further comprising separating the avian fibroblast cells from the growth media or removing the cells from a bioreactor or a scaffold.
11. The method of claim 10, wherein the avian fibroblast cells are separated by centrifugation, filtration, flocculation, coagulation, a press, and/or gravity or combination thereof.
12. The method of claim 10 where the filtration type is micro or ultra-filtration or a combination thereof.
13. The method of claim 10, further comprising separating the avian fibroblast cells enzymatically or mechanically.
14. The method of any of the preceding claims, wherein the method occurs in a suspension culture system in batch, fed-batch, semi continuous (fill and draw), continuous, or perfusion culture or some combination thereof.
15. The method of claim 14, wherein the suspension culture achieves a cell density of 0.25x 10^6 cells.ml, 0.5x10^6 cells/ml and 1.0x 10^6 cells/ml, between 1.0x 10^6 cells/ml and 2.0x 10^6 cells/ml, between 2.0x 10^6 cells/ml and 3.0x 10^6 cells/ml, between 3.0x 10^6 cells/ml and 4.0x 10^6 cells/ml, between 4.0x 10^6 cells/ml and 5.0x 10^6 cells/ml, between 5.0x 10^6 cells/ml and 6.0x 10^6 cells/ml, between 6.0x 10^6 cells/ml and 7.0x 10^6 cells/ml, between 7.0x 10^6 cells/ml and 8.0x 10^6 cells/ml, between 8.0x 10^6 cells/ml and 9.0 X 10^6 cells/ml, between 9.0x 10^6 cells/ml and 10x 10^6 cells/ml, between 10x 10^6 cells/ml and 15.0x X 10^6 cells/ml, between 15x X 10^6 cells/ml and 20x X 10^6 cells/ml, between 20x X 10^6 cells/ml and 25x10^6 cells/ml, between 25x 10^6 cells/ml and 30x 10^6 cells/ml, between 30 X 10^6 cells/ml and 35x 10^6 cells/ml, between 35x 10^6 cells/ml and 40x 10^6 cells/ml, between 40x 10^6 cells/ml and 45 x10^6 cells/ml, between 45x 10^6 cells/ml and 50x 10^6 cells/ml, between 50x 10^6 cells/ml and 55x 10^6 cells/ml, between 55x 10^6 cells/ml and 60x 10^6 cells/ml, between 60x 10^6 cells/ml and 65x 10^6 cells/ml, between 70x 10^6 cells/ml and 75x 10^6 cells/ml, between 75x 10^6 cells/ml and 80x 10^6 cells/ml, between 85x 10^6 cells/ml and 90x 10^6 cells/ml, between 90x 10^6 cells/ml and 95x 10^6 cells/ml, between 95x 10^6 cells/ml and 100x 10^6 cells/ml, between 100x 10^6 cells/ml and 125x 10^6 cells/ml, or between 125x 10^6 cells/ml and 150x 10^6 cells/ml.

16. The method of claim 14 or 15, wherein the suspension culture system can be performed in vessel that is at least 500 liters (L), 1,000 L, 2,000 L, 2,500 L, 5,000 L, 10,000 L, 25,000 L, 50,000 L, 100,000 L, 200,000 L, or 500,000L.
17. The method of any of the preceding claims, further comprising improving one or more of maintenance, proliferation, differentiation, lipid accumulation, lipid content, purification and/or harvest efficiency, growth rates, cell densities, cell weight, resistance to contamination, avian fibroblast -specific gene expression and/or protein secretion, shear sensitivity, flavor, texture, color, odor, aroma, gustatory quality, nutritional quality, minimized growth-inhibitory byproduct secretion, and/or minimized media requirements, of avian fibroblast cells, in any culture conditions, by one or more of growth factors, fatty acids, proteins, elements, small molecules, directed evolution, genetic engineering, media composition, bioreactor design, and/or scaffold design.
18. The method of claim 17, wherein the fatty acids comprise stearidonic acid and linolenic acid.
19. The method of claim 17, wherein the growth factor comprises insulin growth factor, fibroblast growth factor, and epidermal growth factor.
20. The method of claim 17, wherein the protein comprises transferrin.
21. The method of claim 17, wherein the element comprises selenium.
22. The method of claim 17, wherein the small molecule comprises ethanolamine.
23. The method of claim 17, wherein the small molecule is a lactate dehydrogenase inhibitor.
24. The method of claim 23, wherein the lactate dehydrogenase inhibitor is selected from the group consisting of oxamate, galloflavin, gossypol, quinoline 3-dulfonamides, N-hydroxyindole-based inhibitors, and FX11.
25. The method of claim 24, wherein the lactate dehydrogenase inhibitor is oxamate.
26. The method of claim 25, wherein the concentration of oxamate in the growth medium is selected from the group consisting of 1-500mM, 1-400mM, 1-300mM, 1-250mM, between 1-200mM, 1-175mM, 1-150mM, 1-100mM, 1-50mM, and 1-25mM.
27. The method of any one of claims 1 to 26, wherein the growth medium comprises a sugar selected from the group consisting of glucose and mannose.
28. The method of claim 27, wherein the growth medium comprises glucose or mannose.

29. The method of claim 27, wherein the amount of glucose and/or mannose in the growth medium is 1-10 g/L, 1-9 g/L, 1-8 g/L, 1-9 g/L, 1-8 g/L, 1-7 g/L, 1-6 g/L, 1-5 g/L, 1-4 g/L, 1-3 g/L, 1-2 g/L.
30. The method of claim 27, wherein amount of glucose in the growth medium is 1-10 g/L, 1-9 g/L, 1-8 g/L, 1-9 g/L, 1-8 g/L, 1-7 g/L, 1-6 g/L, 1-5 g/L, 1-4 g/L, 1-3 g/L, 1-2 g/L and the amount of mannose in the growth medium is 1-10 g/L, 1-9 g/L, 1-8 g/L, 1-9 g/L, 1-8 g/L, 1-7 g/L, 1-6 g/L, 1-5 g/L, 1-4 g/L, 1-3 g/L, 1-2 g/L.
31. The method of claim 1, wherein the edible food product comprises:
a cell paste, the cell paste content in an amount of at least 90%, 80%, 75%, 70%, 65%, 60%, 50%, or 25% by weight, and wherein the cell paste content is made from avian fibroblast cells grown *in vitro*.
32. The method of claim 31, wherein the edible food product further comprises a mung bean protein, the mung bean protein content in an amount of at least 5% by weight.
33. The method of claim 31, wherein the edible food product further comprises a fat, the fat content in an amount of at least 5% by weight.
34. The method of claim 31, wherein the edible food product further comprises a water, the water content of at least 20% by weight.
35. The method of any of the previous claims, wherein the food product resembles avian nuggets, avian tenders, avian breasts, avian oysters, avian feet, avian wings, avian sausage, avian feed stock, and avian skin.
36. The method of claim 1, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises hydrating plant protein isolate in conditioned water to produce a hydrated plant protein.
37. The method of claim 36, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises adding cell paste to the hydrated plant protein.
38. The method of claim 1, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises:
    a. conditioning water with phosphates to prepare conditioned water;
    b. hydrating a plant protein isolate, with the conditioned water to produce hydrated plant protein;
    c. contacting cell paste and hydrated plant protein to produce a cell and protein mixture;

d. heating the cell and protein mixture in steps, wherein the steps comprise at least one of:
    i. ramping up the temperature of the cell and protein mixture to a temperature between 40-65 °C;
    ii. maintaining the temperature of the cell and protein mixture at a temperature between 40-65 °C for at least 15 minutes;
    iii. ramping up the temperature of the cell and protein mixture to a temperature between 60-85 °C to prepare a pre-cooking product;
    iv. optionally, cooling the cell and protein mixture to a temperature of a temperature between 5-15 °C to prepare a pre-cooking product;
e. optionally adding an oil at steps (i), (ii), (iii), (iv) or to the pre-cooking product; and
f. optionally, cooking the pre-cooking product to prepare the avian food product.

39. The method of claim 38, wherein the plant protein isolate is selected from the group consisting of a pulse protein isolate.
40. The method of claim 39, wherein the pulse protein isolate is a mung bean protein isolate.
41. The method of claim 40, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises heating the cell and protein mixture in steps, wherein the steps comprise at least one of:
    a. ramping up the temperature of the cell and protein mixture to a temperature between 40-65 °C;
    b. maintaining the temperature of the cell and protein mixture for at least 15 minutes;
    c. ramping up the temperature of the cell and protein mixture to a temperature between 60-85 °C.
42. The method of any of claims 38-41, wherein step (i) further comprises adding seasoning to the cell and protein mixture.
43. The method of any of claims 38-42, wherein step (ii) further comprises adding a peptide cross-linking enzyme.
44. The method of claim 43, wherein the cross-linking enzyme is selected from the group consisting of transglutaminase, sortase, subtilisin, tyrosinase, laccase, peroxidase, and lysyl oxidase.

45. The method of claim 44, wherein the transglutaminase is added at a concentration of between 0.0001%-0.025%, 0.0001%-0.020%, 0.0001%-0.0175%, 0.0001%-0.0150%, 0.0001%-0.0125%, 0.0001%-0.01%, 0.0001%-0.0075%, 0.0001%-0.005%, 0.0001%-0.0025%, 0.0001%-0.002%, 0.0001%-0.0015%, 0.0001%-0.001%, 0.0001%-0.00015% by weight.
46. The method of claim 38, wherein step (iii) further comprises adding oil.
47. The method of claim 1, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises cooling the cell and protein mixture to a temperature between 5-10 °C.
48. The method of claim 1, wherein formulating the recovered avian fibroblast cells into an edible food product further comprises adding an oil at steps (i), (ii), (iii), or (iv) to create a pre-cooking product.
49. The method of claim 48, further comprising at least one of:
    a. frying the pre-cooking product;
    b. baking the pre-cooking product;
    c. grilling the pre-cooking product; and
    d. freezing the pre-cooking product.
50. A method of preparing for consumption, an avian product made from avian fibroblast cells grown *in vitro*, the method comprising:
    a. conditioning water with phosphates;
    b. hydrating a pulse protein isolate with the conditioned water to produce hydrated pulse protein;
    c. adding cell paste into the hydrated pulse protein to produce a cell and protein mixture;
    d. heating the cell and protein mixture in steps, wherein the steps comprise at least one of:
        i. ramping up the temperature of the cell and protein mixture to a temperature between 40-65 °C;
        ii. maintaining the temperature of the cell and protein mixture at least 15 minutes;
        iii. ramping up the temperature of the cell and protein mixture to a temperature between 60-85°C;
    e. cooling the cell and protein mixture to a temperature of between 5-15 °C; and

f. adding an oil to the cell and protein mixture to create a pre-cooking product; and

g. cooking the pre-cooking product to prepare the edible food product.

51. The method of claim 50, further comprising at least one of:

a. frying the pre-cooking product;

b. baking the pre-cooking product;

c. grilling the pre-cooking product; and

d. freezing the pre-cooking product.

52. The method of claim 50, wherein step (i) further comprises adding seasoning to the water.

53. The method of claim 50, wherein step (ii) further comprises adding a peptide cross-linking enzyme.

54. The method of claim 53, wherein the peptide cross-linking enzyme is selected from the group consisting of transglutaminase, sortase, subtilisin, tyrosinase, laccase, peroxidase, and lysyl oxidase.

55. The method of claim 53, wherein the peptide cross-linking enzyme is a transglutaminase.

56. The method of claim 50, wherein step (iii) further comprises adding oil.

57. The method of any of the previous claims, wherein the cells comprise primary avian fibroblast cells.

58. The method of any of the previous claims, wherein the cells comprise secondary avian fibroblast cells.

59. A food product produced by the method of any of the previous claims.

60. A food product produced from avian fibroblasts, comprising:

a. a cell paste, the cell paste content in an amount of at least 25% by weight, and wherein the cell paste is made from avian fibroblast cells grown *in vitro*;

b. a mung bean protein, the mung bean protein content in an amount of at least 15 by weight;

c. a fat, the fat content in an amount of at least 1% by weight; and

d. a water, the water content in an amount of at least 20% by weight.