CLAIMS

We claim:

~~1. A flavor enhancer comprising a heme-containing polypeptide from a microorganism.~~

~~2. The flavor enhancer according to claim 1, wherein the polypeptide releases heme when heated, thereby imparting a meat-like flavor and/or aroma.~~

~~3. The flavor enhancer according to claim 1, wherein the heme-containing polypeptide is processed from the microorganism as single cell protein, protein hydrolysate, cell lysate, protein isolate, protein extract, peptides, and/or oligopeptides, and/or is isolated or purified from the microorganism.~~

~~4. The flavor enhancer according to claim 1, wherein the heme-containing polypeptide is a heme-containing domain of a heme-containing enzyme.~~

~~5. The flavor enhancer according to claim 1, wherein the microorganism is a knallgas microorganism.~~

~~6. The flavor enhancer according to claim 1, wherein the knallgas microorganism is a *Cupriavidus* microorganism.~~

~~7. The flavor enhancer according to claim 5, wherein the Cupriavidus microorganism is *Cupriavidus necator*.~~

~~8. The flavor enhancer according to claim 5, wherein the knallgas microorganism is grown under microaerobic conditions.~~

~~9. The flavor enhancer according to claim 1, wherein the microorganism is engineered for overexpression of the heme-containing polypeptide.~~

[Claim 1~~0~~]. A structured food product, comprising a flavor enhancer ~~according to claim 1~~ comprising a heme-containing polypeptide from a microorganism, and a protein product from a microorganism, wherein the flavor enhancer and the protein product may be derived from the same or different microorganisms,

wherein the microorganism from which the flavor enhancer and/or the protein product is derived is a first microorganism grown on a nutritional source that comprises a protein product from a second microorganism.

[Claim 2~~11~~]. The structured food product according to claim 1~~0~~, wherein the microorganism from which the flavor enhancer and/or the protein product is derived comprises a chemoautotrophically grown microorganism.

[Claim 3~~12~~]. The structured food product according to claim 2~~11~~, wherein the chemoautotrophically grown microorganism comprises a *Cupriavidus* microorganism.

~~13. The structured food product according to claim 10, wherein the microorganism from which the flavor enhancer and/or the protein product is derived is a first microorganism grown on a nutritional source that comprises a protein product from a second microorganism.~~

[Claim 4~~14~~]. The structured food product according to claim 1~~13~~, wherein the second microorganism comprises a *Cupriavidus* microorganism.

[Claim 5~~15~~]. The structured food product according to claim 1~~13~~, wherein the first microorganism is a generally recognized as safe (GRAS) microorganism.

[claim 6~~16~~]. The structured food product according to claim 1~~10~~, wherein the microorganism from which the flavor enhancer and/or the protein product is derived is a non-genetically modified organism (non-GMO).

[Claim 7~~17~~]. The structured food product according to claim 1~~10~~, wherein the food product does not contain animal-derived biomolecules.

[Claim 8~~18~~]. The structured food product according to claim 1~~10~~, wherein the protein product comprises one or more of single cell protein, cell lysate, protein isolate, protein extract, protein hydrolysate, free amino acids, peptides, oligopeptides, and combinations thereof.

[Claim 9~~19~~]. The structured food product according to claim 1~~10~~, comprising about 5% ~~-~~to about 50% protein by weight from the microorganism protein product.

[Claim 10~~20~~]. The structured food product according to claim 1~~10~~, wherein the food product is a structured meat analogue product.

[Claim 11~~21~~]. The structured food product according to claim 10~~20~~, wherein the structured meat analogue product is a structured beef, poultry, pork, fish, or seafood analogue product.

[Claim 1222]. The structured food product according to claim 1020, wherein the structured meat analogue product reproduces a texture and/or organoleptic characteristic of natural meat.

[Claim 1323]. The structured food product according to claim 1020, wherein the meat analogue product mimics the structure of ground or muscle meat.

[Claim 1424]. The structured food product according to claim 110, wherein the structured food product is supplemented with vitamins and/or nutrients.

[Claim 1525]. The structured food product according to claim 1424, wherein the supplemental vitamins and/or nutrients comprise at least one of amino acids, lipids, oils, fatty acids, vitamin B12, biotin, antioxidants, minerals, surfactants, and emulsifiers.

[Claim 1626]. The structured food product according to claim 1424, wherein the structured food product is a structured meat analogue product.

[Claim 1727]. A dough composition for production of a structured food product, comprising a flavor enhancer comprising a heme-containing polypeptide from a microorganism~~according to claim 1~~, and a protein product from a microorganism, wherein the flavor enhancer and the protein product may be derived from the same or different microorganisms,

wherein the protein product comprises one or more of single cell protein, cell lysate, protein isolate, protein extract, protein hydrolysate, free amino acids, peptides, oligopeptides, and combinations thereof,

wherein the protein product comprises a protein hydrolysate, and

wherein the protein hydrolysate is produced under conditions that retain undenatured globular protein.

[Claim 1828]. The dough composition according to claim 1727, wherein the microorganism from which the flavor enhancer and/or the protein product is derived comprises a chemoautotrophically grown microorganism.

[Claim 1929]. The dough composition according to claim 1828, wherein the chemoautotrophically grown microorganism comprises a *Cupriavidus* microorganism.

~~30. The dough composition according to claim 27, wherein the protein product comprises one or more of single cell protein, cell lysate, protein isolate, protein extract, protein hydrolysate, free amino acids, peptides, oligopeptides, and combinations thereof.~~

~~31. The dough composition according to claim 30, wherein the protein product comprises a protein hydrolysate.~~

[Claim 2032]. The dough composition according to claim 1731, wherein the average molecular weight of proteins in the hydrolysate is about 5 kD to about 10 kD.

~~33. The dough composition according to claim 31, wherein the protein hydrolysate is produced under conditions that retain undenatured globular protein.~~

[Claim 2134]. The dough composition according to claim 1733, wherein the conditions that retain undenatured globular protein comprise mild cell lysis and physical separation of soluble components from cell debris,

[Claim 2235]. The dough composition according to claim 1733, wherein partially or fully hydrolyzed protein product is added to a second protein product to promote structuring and/or fiber formation.

[Claim 2336]. The dough composition according to claim 2235, wherein the second protein product comprises one or more of wheat gluten, soy, pea, wheat, milk, algae, and other non-animal proteins.

[Claim 2437]. The dough composition according to claim 1727, wherein the water content of the dough is about 40% (w/w) to about 80% (w/w).

[Claim 2538]. The dough composition according to claim 1727, wherein the shear strength of the dough is greater than about 1000 psig.

~~39. A method for producing a structured food product, comprising:~~

~~(a) culturing a microorganism in the presence of a carbon source, thereby producing biomass that comprises protein, wherein the biomass comprises at least one heme-containing polypeptide;~~

~~(b) converting the biomass into a protein product; and~~

~~(c) processing the protein product into a structured food composition.~~

~~40. A method for producing a structured food product, comprising:~~

~~(a) culturing a microorganism in the presence of a carbon source, thereby producing biomass that comprises protein;~~

~~(b) converting the biomass into a protein product; and~~

~~(c) processing the protein product into a structured food composition,~~

wherein step (b) or step (c) comprises addition of a flavor enhancer, wherein the flavor enhancer comprises a heme-containing polypeptide from a microorganism, and wherein the flavor enhancer and the protein product may be derived from the same or different microorganisms .

41. The method according to claim 39 or 40, wherein step (a) comprises chemoautotrophic culture conditions.

42. The method according to claim 41, wherein the chemoautotrophic culture conditions comprise microaerobic culture conditions.

43. The method according to claim 39 or 40, wherein the carbon source comprises a gaseous C1 molecule.

44. The method according to claim 43, wherein the gaseous C1 molecule comprises carbon dioxide.

45. The method according to claim 41, wherein the microorganism comprises a *Cupriavidus* microorganism.

46. The method according to claim 39 or 40, wherein the protein product comprises one or more of single cell protein, cell lysate, protein isolate, protein extract, protein hydrolysate, free amino acids, peptides, oligopeptides, and combinations thereof.

47. The method according to claim 46, wherein step (c) comprises processing the protein product into a dough composition.

48. The method according to claim 47, further comprising thermochemical processing of the dough.

49. The method according to claim 48, wherein the thermochemical processing comprises extrusion.

50. The method according to claim 47, wherein step (c) comprises a spinning process, thereby producing fibers.

~~51. The method according to claim 47, wherein step (c) comprises a process for structured hydrocolloid formation.~~

~~52. The method according to claim 39 or 40, wherein the structured food product is a structured meat analogue product.~~

~~53. The method according to claim 52, wherein the structured meat analogue product is a structured beef, poultry, pork, fish, or seafood analogue product.~~

~~54. The method according to claim 52, wherein the structured meat analogue product reproduces a texture and/or organoleptic characteristic of natural meat.~~

~~55. The method according to claim 52, wherein the meat analogue product mimics the structure of ground or muscle meat.~~

~~56. A thermochemical process for processing a dough composition according to claim 27 into a structured meat analogue composition, comprising extruding the dough composition to produce aligned fibers.~~

~~57. A thermochemical process according to claim 56, wherein the protein product comprises a protein hydrolysate.~~

~~58. The thermochemical process according to claim 57, wherein the microorganism comprises a chemoautotrophically grown microorganism.~~

~~59. The thermochemical process according to claim 58, wherein the chemoautotrophically grown microorganism comprises a *Cupriavidus* microorganism.~~