IN THE UNITED STATES DISTRICT COURT
FOR DISTRICT OF DELAWARE

IMPOSSIBLE FOODS INC.,	)	
Plaintiff,	)	C.A. No. 22-311 (WCB)
v.	)	[redacted]
MOTIF FOODWORKS, INC.,	)	
Defendant.	)	

DECLARATION OF PAUL SARNOSKI, PH.D.

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I. INTRODUCTION AND BACKGROUND

1. I, Paul Sarnoski, Ph.D., have been retained as an expert witness by plaintiff Impossible Foods Inc. ("Impossible") to provide testimony in the above-captioned litigation against defendant Motif FoodWorks, Inc. ("Motif").

2. I have been asked to provide opinions as to the disputed terms of certain asserted claims of U.S. Patent Nos. 10,863,761 ("'761 patent"), 9,943,096 ("'096 patent"), 10,039,306 ("'306 patent"), 11,013,250 ("'250 patent") and 11,224,241 ("'241 patent") (collectively, the "Food Product Patents") based on the understanding of a person of ordinary skill in the art ("POSA"). The disputed terms and each party's proposed interpretation of that term are set forth below.

3. I have formed my opinions using my education, knowledge, and experience together with my review of the materials cited in this declaration. I have reviewed the Food Product Patents and their prosecution histories. I also have considered the parties' proposed meanings for the terms discussed below. I have based my opinions in this declaration on the information currently available to me.

4. Accordingly, I reserve the right to change, amend, and supplement my opinions in response to any new information made available to me; additional scientific analysis that leads me to conclude that supplementation is necessary; new issues that may arise; and any additional arguments, evidence, or testimony.

5. I reserve the right to testify with regard to my qualifications, experience, and the materials I have reviewed. I also reserve the right to respond, as appropriate, to documents, information, or declarations that Motif produces.

6. I have not provided either trial or deposition testimony in any cases in the past four years.

7. I have no financial interest in the outcome of this case. I am being compensated at my standard consulting rate, which is $300 per hour. My compensation is not related in any way to the outcome of this lawsuit.

II. QUALIFICATIONS AND EXPERIENCE

8. The following is a brief summary of my qualifications and experience, the full extent of which is in my curriculum vitae, attached to this declaration as Exhibit A.

9. I currently hold the position of Graduate Program Director and Associate Professor in the Food Science and Human Nutrition Department at the University of Florida. As the Graduate Program Director, I serve as an advisor and mentor for graduate and undergraduate students.

10. My current research focus includes developing fruits and vegetables with improved flavor through breeding and postharvest processing strategies. I also conducted research in the area of meat and seafood flavor and quality. I oversee and supervise laboratory staff.

11. I have taught at the University of Florida since June 2012. I currently teach several courses at the University of Florida, including Advanced Food Chemistry; Flavor Chemistry and Technology; and Instrumental Analysis & Separations.

12. Prior to joining the University of Florida, I was a Research Food Technologist for the U.S. Department of Agriculture, focusing on sustainable agriculture.

13. In 2010, I received my Ph.D in Food Science and Technology from the Virginia Polytechnic Institute and State University (Virginia Tech). I also received my Master of Science in Food Science and Technology from Virginia Tech, and I hold a Bachelor of Arts in Chemistry with a minor in Physics from Wilkes University.

14. I have authored or coauthored about 50 peer-reviewed publications and peer-reviewed book chapters in the area of food chemistry and technology in well-known journals in the field such as Food Chemistry, Journal of Food Science, Journal of Agricultural and Food Chemistry, International Journal of Food Engineering, International Journal of Food Science & Technology, and the Journal of Food Safety.

15. I regularly attend and present at industry and educational conferences concerning food science and technology, including the International Association for Food Protection and the Institute of Food Technologists (IFT) Annual Meeting.

16. I have also served as an editor and reviewer for over 10 different scientific journals in the field, including Food Chemistry, the Journal of Agricultural and Food Chemistry, and the Journal of Food Science.

III. LEGAL PRINCIPLES

17. Counsel for Impossible has asked me to offer my opinions on the meaning of certain terms in the Food Product Patents. I have no formal legal training. In order to form my opinions on these questions, counsel explained to me the legal standards and general guidelines relevant to determining the meaning of patent claims. Below, I set forth my understanding of these standards, which provide the framework for my analysis.

18. I understand from counsel that patent claims are interpreted from the perspective of a person of ordinary skill in the art (a "POSA"), in the context of the patent as a whole, as of the priority date. I understand from counsel that those dates are July 12, 2011 for the '761 patent and January 11, 2013 for the '096, '241, '306, and '250 patents. I have formed my opinions based on the knowledge and understanding of a POSA as of these dates. I further understand that a POSA is presumed to have knowledge of all pertinent prior art.

19. In forming my opinions, I have considered the qualifications of a POSA based on my review of the Food Product Patents and their file histories. In my view, a POSA would have at least a graduate degree in food science, biology, chemistry, or a similar discipline, plus 2 years of experience as a food scientist. I am at least a POSA under this definition.

20. I understand that unless the patent claims, the specification, and the prosecution history indicate otherwise, the claim terms of the Food Product Patents should be given their plain and ordinary meaning, which is the meaning that the terms would have had to a POSA as of the relevant date. Counsel has advised me that this analysis focuses on the patent claims, the specification, and the prosecution history. I also understand that dictionaries or other extrinsic sources can be helpful in determining the plain and ordinary meaning of a term but cannot override a meaning that is clear from the patent claims, the specification, and the prosecution history.

21. Counsel has informed me that a patent claim may be considered indefinite if, in the context of the patent specification and prosecution history, it fails to inform a POSA about the scope of the claimed invention with reasonable certainty.

IV. THE FOOD PRODUCT PATENTS

A. Relevant Background

22. The Food Product Patents relate to the field of food science and methods and compositions for meat alternative food products.

B. Overview of the ’761 Patent

23. I understand that Impossible and Motif disagree about the meaning of certain terms in the claims of the ’761 patent.

24. The ’761 patent is entitled “Methods and Compositions for Consumables” and generally discusses improved methods and compositions that replicate the characteristics that

consumers value in preparation and consumption of meat food products. The replicas are plant-based, and thereby overcome some of the negative impacts on human health and the environment related to meat consumption. The '761 patent further discusses several replicas—muscle replica, fat replica, connective tissue replica—which can be assembled into a beef replica product. The '761 patent also teaches that addition of heme and other compounds (sugars, sulfur-containing compounds) allows for production and release of volatile compounds upon cooking that mimic organoleptic properties of meat, thereby improving the consumer experience.

1. The Claims of the '761 Patent

25. Specifically, the '761 patent claims and describes a "beef replica product comprising: a) a muscle replica comprising 0.1%-5% of a heme-containing protein, at least one sugar compound and at least one sulfur compound; and b) a fat tissue replica comprising at least one plant oil and a denatured plant protein, wherein said muscle replica and fat tissue replica are assembled in a manner that approximates the physical organization of meat."

26. Dependent claim 3 of the '761 patent is directed to the beef replica product of claim 1, "wherein the denatured plant protein comprises one or more isolated non-heme-containing proteins."

27. Dependent claim 10 of the '761 patent is directed to the beef replica product of claim 1, "wherein said beef product contains less than 5% carbohydrates."

28. Dependent claim 11 of the '761 patent is directed to the beef replica product of claim 1, "wherein said beef replica product is characterized by one or more of the following: contains no tofu, contains no soy protein, contains less than 1% cellulose, contains less than 5% insoluble carbohydrates, or contains no wheat gluten."

29. Dependent claim 12 of the '761 patent is directed to the beef replica product of claim 1, "wherein said beef replica product contains no animal products and less than 5% carbohydrates."

30. Dependent claim 13 of the '761 patent is directed to the beef replica product of claim 1, "wherein said beef replica product contains no wheat gluten and less than 5% insoluble carbohydrates."

2. The Specification of the '761 Patent

31. The '761 patent describes compositions of consumables that can mimic or replicate animal-based foods and methods for producing such compositions. '761 patent, 18:12-13; 18:28-29. For example, these consumables can be "designed to replicate the experience of eating meat. The look, texture, and taste of the consumable can be such that it is similar or indistinguishable from meat." *Id.* at 20:17-20. These may replicate, for example, ground beef. *Id.* at 46:22-45; Figures 15-16. The '761 patent further explains how these consumables may have similar characteristics as traditional meat, which may include the force required to pierce the consumable as compared to meat. *Id.* at 21:34-42.

32. The '761 patent teaches the consumables may have a similar or the same physical organization of traditional cuts of meat, which "can be manipulated by controlling the localization, organization, assembly, or orientation of the muscle, fat, and/or connective tissue replicas" to mimic meat before and/or after cooking. *Id.* at 23:24-41. Some of these traditional cuts of meat replicated can be "different cuts of beef, such as, e.g., ribeye, filet mignon, London broil, among others." *Id.* at 23:37-41.

33. The '761 patent explains that these replicas include skeletal muscle replicas, fat replicas, and connective tissue replicas, which can be designed to replicate the similar structures in traditional meat. *Id.* at 25:33-47; 27:9-19; 30:50-63. These may be organized in specific

fashions to replicate the organization of meat. For example, "in some embodiments the muscle replica comprises fibers that are to some extent organized isotropically." *Id.* at 25:50-53. As another example, the fat replica "comprises a gel with droplets of fat suspended therein." *Id.* at 27:23-25. The '761 patent teaches that "[a]nimal connective tissue can generally be divided into fascia-type and cartilage-type tissue. Fascia-type tissue is highly fibrous, resistant against extension (has high elastic modulus), and has a high protein content, a moderate water content (ca. 50%), and low-to-none fat and polysaccharide content;" thus, the connective tissue replica may, for example, "comprise[] about 50% protein by total weight, about 50% by liquid weight, and has a low fat and polysaccharide component." *Id.* at 30:64-31:7.

34. Importantly, the '761 patent teaches, for example, that "the meat substitute products, muscle tissue replica, fat replica, or connective tissue replica, comprise one or more isolated, purified proteins." *Id.* at 23:43-45. These proteins may be "derived from non-animal sources" which "include plants, funghi, bacteria, archaea, genetically modified organisms such as genetically modified bacteria or yeast, chemical or in vitro synthesis." *Id.* at 23:65-24:3.

35. Further, the '761 patent teaches these replicas can contain the components of the meat they replicate. The patent teaches "animal muscle tissue include[s] sodium, potassium, calcium, magnesium, other metal ions, lactic acid, other organic acids, free amino acids, peptides, nucleotides and sulfur compounds" and so, for example, "the muscle replica can include sodium, potassium, calcium, magnesium, other metal ions, lactic acid, other organic acids, free amino acids, peptides, nucleotides and sulfur compound." *Id.* at 26:31-37. The patent teaches these components may assist in recreating organoleptic properties of meat cooking. For example, "[o]dorants released during cooking of meat are generated by reactions that can involve as reactants fats, protein, amino acids, peptides, nucleotides, organic acids, sulfur compounds,

sugars and other carbohydrates." *Id.* at 36:18-21. These reactions "can be catalyzed by iron, in particular the heme iron of myoglobin;" thus, for example, "the characteristic flavor and fragrance components are produced during the cooking process by chemical reactions catalyzed by iron." *Id.* at 36:34-48. These may be produced, for example, by "heme," "leghemoglobin," or more generally "a heme protein." *Id.*

C. Overview of the '096 and '241 Patents

36. I understand that Impossible and Motif disagree about the meaning of certain terms in the claims of the '096 and '241 patents.

37. The '096 and '241 patents are entitled "Methods and Compositions for Affecting the Flavor and Aroma Profile of Consumables" and generally discuss food products containing flavor precursors that modulate the flavor and/or aroma profile to mimic meat with a plant based or meat-like product. The patents also detail compounds that are released on cooking/heating of such products and the resulting perception of the consumer.

1. The Claims of the '096 and '241 Patents

38. Specifically, the '096 patent claims and describes a "food flavor additive composition comprising: a) an isolated heme-containing protein; b) a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, maltodextrin, and galactose, and mixtures of two or more thereof; and c) a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof; wherein the flavor additive composition contains no animal products; and wherein cooking the food flavor additive composition results in the production of at least two volatile compounds which have a meat-associated aroma."

39. Dependent claim 2 of the '096 patent is directed to the food flavor additive composition of claim 1, "wherein the heme-containing protein is selected from the group

consisting of a androglobin, a cytoglobin, a globin E, a globin X, a globin Y, a hemoglobin, a myoglobin, a leghemoglobin, an erythrocruorin, a beta hemoglobin, an alpha hemoglobin, a protoglobin, a cyanoglobin, a cytoglobin, a histoglobin, a neuroglobins, a chlorocruorin, a truncated hemoglobin, a truncated 2/2 globin, and a hemoglobin 3."

40. Dependent claim 3 of the '096 patent is directed to the food flavor additive composition of claim 1, "wherein the heme-containing protein comprises amino acid sequence having at least 80% sequence identity to a polypeptide set forth in SEQ ID NOs: 1-26."

41. The '241 patent has two independent claims, claims 1 and 22, which I describe below.

42. Claim 1 recites "[a] meat-like-food product produced by a method comprising: providing one or more plant proteins; and combining, with the one or more plant proteins: a composition comprising a heme-containing protein, wherein the composition comprises at least 60% of the heme-containing protein on a dry weight basis; a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose, and mixtures of two or more thereof; and a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof in a concentration of at least 1.5 mM; wherein the meat-like food product is free of animal heme-containing protein; wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma; and wherein the meat-like food product is in a form selected from the group consisting of a hotdog, a burger, ground meat, a sausage, a steak, a filet, a roast, a meatball, a meatloaf, or bacon."

43. Claim 22 recites: "[a] meat-like-food product produced by a method comprising: providing one or more plant proteins; and combining, with the one or more plant proteins: a

heme-containing protein; one or more of glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose; and one or more of cysteine, cystine, thiamine, and methionine; wherein the meat-like food product is free of animal heme-containing protein; wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma; and wherein the meat-like food product is in a form selected from the group consisting of a hotdog, a burger, ground meat, a sausage, a steak, a filet, a roast, a meatball, a meatloaf, or bacon."

44. Dependent claim 7 of the '241 patent is directed to the meat-like-food product of claim 1, "wherein the heme-containing protein comprises an amino acid sequence having at least 80% sequence identity to a polypeptide set forth in SEQ ID NOs. 1-26."

45. Dependent claim 12 of the '241 patent is directed to the meat-like-food product of claim 1, "further comprising combining with the one more plant proteins, one or more of a vegetable oil, an algal oil, sunflower oil, corn oil, soybean oil, palm fruit oil, palm kernel oil, safflower oil, flaxseed oil, rice bran oil, cottonseed oil, olive oil, canola oil, flaxseed oil, coconut oil, and mango oil."

46. Dependent claim 16 of the '241 patent is directed to the meat-like-food product of claim 1, "wherein at least a portion of the meat-like food product, upon cooking, transitions in color from a pink to red color in a raw or uncooked state to a lighter pink to brown color in a partially cooked to fully cooked state."

47. Dependent claim 17 of the '241 patent is directed to the meat-like-food product of claim 1, "wherein cooking the meat-like-food product results in the production of at least five volatile compounds selected from the group" listed in the claim.

48. Dependent claim 20 of the ’241 patent is directed to the meat-like-food product of claim 1, “wherein the at least two volatile compounds are selected from 2-methyl-furan, bis(2-methyl-3-furyl)disulfide, 2-pentyl-furan, 3,3′-dithiobis-2-methyl-furan, 2,5-dimethyl-pyrazine, 2-methyl-3-furanthiol, dihydro-3-(2H)-thiophenone, 5-methyl-2-thiophenecarboxaldehyde, 3-methyl-2-thiophenecarboxaldehyde, 2-methyl-thiazole, dimethyl sulfide, decanal, 5-ethyldihydro-2(3H)-furanone, dihydro-5-pentyl-2(3H)-furanone, 2-octanone, 3,5-octadien-2-one, p Cresol, p cresol, and hexanoic acid.”

49. Dependent claim 23 of the ’241 patent is directed to the meat-like-food product of claim 22, “wherein the meat-like food product is free of animal products.”

2. The Shared Specification of the ’096 and ’241 Patents

50. I am informed by counsel that the ’096 and ’241 patents have a shared specification. For simplicity, I will reference the ’241 patent in the discussion that follows.

51. The ’096 and ’241 patents describe “methods and materials for modulating the taste and/or aroma profile of food products,” which include “compositions containing one or more flavor precursors and one or more highly conjugated heterocyclic rings complexed to an iron (referred to herein as an iron complex),” where “[s]uch iron complexes include heme moieties or other highly conjugated heterocylic rings complexed to an iron ion.” ’241 patent at 7:65-8:6. The patents teach “‘[h]eme” refers to a prosthetic group bound to iron (Fe′ or Fe′) in the center of a porphyrin ring” such that “an iron complex can be a heme moiety, or” other compounds complexed to an iron ion. *Id.* at 8:6-12. This heme moiety can then “be used to modulate the taste and/or aroma profile of food products.” *Id.* at 8:12-15. For example, “the iron complexes catalyze some reactions and produce flavor precursors” with or without cooking. *Id.* at 8:23-29.

52. The patents contain examples of flavor precursors, including "sugars, sugar alcohols, sugar derivatives, oils (e.g., vegetable oils), free fatty acids, alpha-hydroxy acids, dicarboxylic acids, amino acids and derivatives thereof, nucleosides, nucleotides, vitamins, peptides, protein hydrolysates, extracts, phospholipids, lecithin, and organic molecules." *Id.* at 8:28-34; Table 1. The patents teach such "[f]lavor precursor molecules or compositions can be added to the uncooked food product in purified form and/or can be derived from ingredients in the uncooked consumable food product that contain and/or are enriched with one or more of the particular flavor precursors or compositions" and that these can include, for example, extracts and/or oils. *Id.* at 2:55-64.

53. The patents define the term "heme containing protein" as interchangeable with "heme containing polypeptide" or "heme protein" or "heme polypeptide" and further defines the terms as including "any polypeptide that can covalently or noncovalently bind a heme moiety." *Id.* at 9:17-21. The patents teach heme containing proteins may be derived or isolated from various sources, including "fungi such as . . . *Pichia pastoris*" and "bacteria such as *Escherichia coli*." *Id.* at 10:5-11. The patents also give examples of such proteins through sequence identities to certain amino acid sequences. *Id.* at 10:30-58.

54. Food products as described in the '096 and '241 patents "containing one or more flavor precursors and one or more heme-containing proteins can be used as a base for formulating a variety of additional food products" or may even "modulate the taste and/or aroma profile of other food products (e.g., meat replicas, meat substitutes, tofu, mock duck or other gluten based vegetable product, textured vegetable protein such as textured soy protein, pork, fish, lamb, or poultry products such as chicken or turkey products)" such that they "can provide a particular meaty taste and smell, for example, the taste and smell of beef or bacon, to a non-meat

product or to a poultry product." *Id.* at 18:12-31. The patent also provides examples of such food products, for example a replica burger. *Id.* at Example 1.

55. The patents explain that these food products "can be assessed using trained human panelists," and such "evaluations can involve eyeing, feeling, chewing, and tasting of the product to judge product appearance, color, integrity, texture, flavor, and mouth feel, etc." *Id.* at 18:63-19:1. The patents describe how "[a] scale can be used to rate the overall acceptability or quality of the food product or specific quality attributes such [as] beefiness, texture, and flavor." *Id.* at 19:7-10. The patents also give other examples of assessment "based upon olfactometer readings," which "can be used to assess odor concentration and odor thresholds, odor suprathresholds with comparison to a reference gas, hedonic scale scores to determine the degree of appreciation, or relative intensity of odors." *Id.* at 19:13-28. As another example, "volatile chemicals identified using GCMS can be evaluated" to "further refine the profile of flavor and aroma compounds produced using a heme-containing protein and one or more flavor precursors." *Id.* at 19:29-34, Table 12.

56. The '096 and '241 patents teach that "[c]haracteristic flavor and fragrance components are mostly produced during the cooking process by chemical reactions molecules including amino acids, fats and sugars which are found in plants as well as meat." *Id.* at 19:35-38. Thus, the patent gives examples of testing that may be conducted before or after cooking to determine the similarity of the food product to meat. *Id.* at 19:38-64. These testing methods are further set forth in examples, such as Examples 8-10. *Id.* at 26:57-37:20.

D. Overview of the '306 and '250 Patents

57. I understand that Impossible and Motif disagree about the meaning of certain terms in the claims of the '306 and '250 patents.

58. The ’306 and ’250 patents are entitled “Methods and Compositions for Consumables” and generally discuss meat replicas that can contain a muscle, fat, and connective tissue analog s which contain other ingredients to better simulate the consumption of meat, and methods of making these replicas.

1. The Claims of the ’306 and ’250 Patents

59. The ’306 patent has three independent claims, claims 1, 14, and 27, which I describe below.

60. Claim 1 recites “[a] method for imparting a beef-like aroma to a meat replica matrix, wherein the meat replica matrix comprises one or more plant proteins, a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof, and at least one sulfur compound selected from methionine, cysteine and thiamine, the method comprising adding 0.01%-5% (by weight of the meat replica matrix) of a non-animal heme-containing protein to the meat replica matrix, wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated that are associated with a beef-like aroma, thereby imparting a beef-like aroma to the meat replica matrix.”

61. Claim 14 recites “[a] method for making a meat replica matrix having a beef-like aroma, wherein the meat replica matrix comprises one or more plant proteins, a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof, and at least one sulfur compound selected from methionine, cysteine and thiamine, the method comprising obtaining a non-animal heme-containing protein; and incorporating 0.01%-5% (by weight of the meat replica matrix) of the non-animal heme-containing protein into the meat replica matrix, wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated that are associated with a beef-like aroma.”

62. Claim 27 recites "[a] method for making a meat replica matrix having a beef-like aroma, wherein the meat replica matrix comprises one or more plant proteins, a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof, and at least one sulfur compound selected from methionine, cysteine and thiamine, the method comprising incorporating 0.01%-5% (by weight of the meat replica matrix) of a non-animal heme-containing protein into the meat replica matrix, wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated that are associated with a beef-like aroma."

63. Dependent claim 18 of the '306 patent is directed to the method of claim 14, "comprising incorporating 0.4-1% (by weight of the meat replica matrix) of the non-animal heme-containing protein into the meat replica matrix."

64. Dependent claim 24 of the '306 patent is directed to the method of claim 14, "wherein the non-animal heme-containing protein is purified."

65. Dependent claim 31 of the '306 patent is directed to the method of claim 27, "comprising incorporating 0.4%-1% (by weight of the meat replica matrix) of the non-animal heme-containing protein into the meat replica matrix."

66. The '250 patent has two independent claims, claims 1 and 13, which I describe below.

67. Claim 1 recites "[a] meat replica matrix comprising: one or more plant proteins; a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof; at least one sulfur compound selected from methionine, cysteine, and thiamine; and 0.01%-5% (by weight of the meat replica matrix) of a non-animal heme-containing protein, wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated that are associated with a beef-like aroma."

68. Claim 13 recites "[a] meat replica matrix comprising: one or more plant proteins; a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof; at least one sulfur compound selected from methionine, cysteine, and thiamine; and 0.01%-5% (by weight of the meat replica matrix) of a non-animal heme-containing protein, wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated, and wherein the at least two volatile compounds are selected from the group consisting of" the compounds listed in the claim.

69. Dependent claim 5 of the '250 patent is directed to the meat-like-food product of claim 1, "wherein the meat replica matrix comprises 0.4%-1% (by weight of the meat replica matrix) of the non-animal heme-containing protein."

70. Dependent claim 10 of the '250 patent is directed to the meat-like-food product of claim 1, "wherein the one or more plant proteins are present in the meat replica matrix in an amount of between 1% and 30% (by weight of the meat replica matrix)."

71. Dependent claim 15 of the '250 patent is directed to the meat-like-food product of claim 13, "wherein the non-animal heme-containing protein has a UV-VIS spectrum that is substantially similar to that of myoglobin from an animal."

72. Dependent claim 17 of the '250 patent is directed to the meat-like-food product of claim 13, "wherein the meat replica matrix comprises 0.4%-1% (by weight of the meat replica matrix) of the non-animal heme-containing protein."

2. The Shared Specification of the '306 and '250 Patents

73. I am informed by counsel that the '306 and '250 patents have a shared specification. For simplicity, I will reference the '306 patent in the discussion that follows.

74. The '306 and '250 patents describe "methods and compositions for producing consumables," which can be "non-animal based replicas of animal-based food products that can

be produced by breaking down non-animal materials into their constituent parts and reassembling those parts into the consumables." '306 patent at 8:36-41. The patents lay out certain advantages of the consumables, including "using less energy or water in the production of the consumable compared to similar food products, using no animals in the production of the consumable," and "using raw materials that would otherwise be discarded." *Id.* at 8:47-59.

75. The '306 and '250 patents explain these consumables "can be made to replicate the food products, e.g., an equivalent meat product." *Id.* at 9:11-14. The patents teach that a consumable, for example, may include "a muscle tissue replica," "an adipose [fat] tissue replica," and/or "a connective tissue replica" such that these replicas "are combined in a manner that recapitulates the physical organization of meat." *Id.* at 9:39-50. The patents provide distinct compositions for these replicas. *Id.* at 29:50-44:25; Examples 2, 7, 14.

76. These compositions may contain certain components that recapitulate the taste and smell of meat during and after cooking, including "heme proteins, amino acids, organic acids, lipids, alcohols, aldehydes, ketones, lactones, furans, sugars,[] other flavor precursor[s]," "thiamine," "phospholipids," *Id.* at 33:56-60; 38:40-50; Examples 33-34. The patents teach that such components may, for example, "provide a more intense beef flavor." *Id.* at 39:31-44.

77. The consumables of the patents "include[] one or more isolated and purified proteins," which "can be derived from non-animal sources such as plants, algae, fungi (e.g., yeast or filamentous fungi), bacteria, or Archaea." *Id.* at 17:33-35; 18:4-7. The patents include examples of such proteins, which can include "an iron-carrying protein such as a heme-containing protein" like "a non-symbiotic type of hemoglobin or a leghemoglobin." *Id.* at 21:15-35; 21:55-22:1. These proteins may be from "mammals," "birds," "plants, algae, fungi," "ciliates, or bacteria" and be isolated from "fungi," "bacteria," "algae," and "protozoans." *Id.* at

22:24-67. The patents teach that the consumables may also contain lipids, fiber, and sugars, and components may be formed into a gel. *Id.* at 26:46-29:49.

78. The '306 and '250 patents teach properties of the consumables and ways of testing these properties to determine the "suitability for a consumable to qualify as a replica of a food product." *Id.* at 12:41-50. Such properties include "mechanical" properties like "chewiness" and "geometric" properties like "particle size" as well as flavor, such as "beefy." *Id.* at 12:50-13:36. Experiments including panels or subjects "can demonstrate that a consumable is acceptable to consumers" and the patents lay out such experiments. *Id.* at 14:20-54. Another example the patents provide are "olfactometer readings," which may be used to determine if a consumable, for example, has a similar or identical olfactometer readings to a food product such that a panelist would not be able determine a difference. *Id.* at 15:24-36; Example 16.

V. ANALYSIS OF THE DISPUTED CLAIM TERMS

A. Term Nos. 1-4: Non-Animal / Free of Animal / No Animal Products

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
1	"a non-animal heme-containing protein"	'306 patent claims 14 and 27 '250 patent claims 1 and 13	"a heme-containing protein that contains no proteins the synthesis of which occurred inside an animal"	"a heme-containing protein that does not have the amino acid sequence of any animal heme-containing protein"
2	"free of animal heme-containing protein"	'241 patent claims 1 and 22	"free of proteins the synthesis of which occurred inside an animal"	"free of any protein that has the amino acid sequence of any animal heme-containing protein"
4	"free of animal products"	'241 patent claim 23	"free of products the synthesis of which occurred inside an animal"	"free of any products that are the same (e.g., amino acid sequence) as those found in an animal"

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
3	"no animal products"	'096 patent claim 1 '761 patent claim 12	"no products the synthesis of which occurred inside an animal"	"no products that are the same (e.g., amino acid sequence) as those found in an animal"

79. A food scientist reading the patents would understand that they do not discuss proteins in the context of where their amino acid sequence is naturally found—the patents discuss recombinant proteins derived or isolated from various sources, including a non-animal genetically engineered organism (e.g., a yeast cell). '241 patent at 12:18-26.

80. This is consistent with claims 2 and 3 of the '096 patent and claim 7 of the '241 patent which require the heme-containing protein is myoglobin or isolated heme proteins that have at least 80% sequence identity to a polypeptide sequence found in an animal—but they are non-animal derived so that they can meet the truthful food labeling claim of containing no animal products:

'096 Patent Claims 2 and 3:

Claim 1: A food flavor additive composition comprising:

(a) **an isolated heme-containing protein**;

(b) a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, maltodextrin, and galactose, and mixtures of two or more thereof; and

(c) a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof;

wherein the flavor additive composition **contains no animal products**;

and wherein cooking the food flavor additive composition results in the production of at least two volatile compounds which have a meat-associated aroma.

Claim 2: The food flavor additive composition of claim 1, wherein the heme-containing protein is selected from the group consisting of a androglobin, a cytoglobin, a

globin E, a globin X, a globin Y, a hemoglobin, **a myoglobin**, a leghemoglobin, an erythrocruorin, a beta hemoglobin, an alpha hemoglobin, a protoglobin, a cyanoglobin, a cytoglobin, a histoglobin, a neuroglobins, a chlorocruorin, a truncated hemoglobin, a truncated 2/2 globin, and a hemoglobin 3.

Claim 3: The food flavor additive composition of claim 1, wherein the **heme-containing protein comprises** [an] amino acid sequence having at least 80% sequence identity to a polypeptide set forth in **SEQ ID NOs: 1-26**.

***SEQ ID No. 18* = *Bos taurus* (bovine myoglobin)**

***SEQ ID No. 19* = *Sus scrofa* (boar myoglobin)**

***SEQ ID No. 20* = *Equus caballus* (equine myoglobin)**

(emphasis added).

'241 Patent Claim 7:

Claim 1: A meat-like-food product produced by a method comprising:

providing one or more plant proteins; and

combining, with the one or more plant proteins:

a composition comprising a heme-containing protein, wherein the composition comprises at least 60% of the heme-containing protein on a dry weight basis;

a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose, and mixtures of two or more thereof;

and a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof in a concentration of at least 1.5 mM;

wherein the meat-like food product is **free of animal heme-containing protein**;

wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma;

and wherein the meat-like food product is in a form selected from the group consisting of a hotdog, a burger, ground meat, a sausage, a steak, a filet, a roast, a meatball, a meatloaf, or bacon.

Claim 7: The meat-like-food product of claim 1, wherein the **heme-containing protein comprises** an amino acid sequence having at least 80% sequence identity to a polypeptide set forth in **SEQ ID NOs. 1-26**.

***SEQ ID No. 18 = Bos taurus* (bovine myoglobin)**

***SEQ ID No. 19 = Sus scrofa* (boar myoglobin)**

***SEQ ID No. 20 = Equus caballus* (equine myoglobin)**

(emphasis added).

81. The proteins in claims 2 and 3 of the '096 patent and claim 7 of the '241 patent are well understood to a food scientist. Dr. Batt's definition of the term "non-animal" would read at least SEQ ID NO 18 (cow myoglobin), SEQ ID NO 19 (boar myoglobin) and SEQ ID NO 20 (horse myoglobin) out of the invention, even though they are expressly included in the claims.

82. I disagree with Dr. Batt and Motif that, in terms of the patent, the term "animal product" or "animal protein" should refer to products that have the same amino acid sequence as those found in an animal.

83. I believe that the patent excerpts contained in Dr. Batt's "Intrinsic Record" section support that "animal" and "non-animal" refer to the source for the protein/product. The "amino acid sequence" language in the '306 patent ('306 patent at 23:10; Batt Decl.[1], ¶ 55) refers to comparing a certain percentage of identity with these protein sequences, which would be expressed in a genetically engineered organism, such as yeast. Once the protein is being expressed from a non-animal source, the patents do not refer to it as an "animal" protein or product. *See, e.g.*, '306 patent at 28:38-41 ("[W]here the protein is derived from non-animal source (e.g., a plant source or ***other non-animal source such as a genetically modified yeast*** or bacteria.")

[1] Declaration of Dr. Carl Batt In Support of Motif's Answering Claim Construction Brief (D.I. 123) ("Batt Decl.").

84. The U.S. Food and Drug Administration ("FDA") maintains Standards of Identity ("SOI") for certain foods. The SOI describes what a food must contain and in what amounts in order to be considered that particularly named food. The SOI may also describe *a method of production* for the named food. Ex. B at IF_0014016. For example, the SOI for "milk" defines that "[m]ilk is the lacteal secretion, practically free from colostrum, *obtained by* the complete milking of one or more healthy cows." 21 CFR § 131.110 (emphasis added).

85. FDA has issued Nonbinding Recommendations regarding Plant-Based Milk Alternatives, another animal/non-animal product. The SOI for "milk" does not preclude use of the name as a common term, but "such use must not be misleading." Ex. C at IF_0013993. The guidance also indicates that the use of terms such as "dairy-free" or "non-dairy" may "help inform customers that the products are *derived from plants*, and are not milk and do not contain milk." *Id.* at IF_0014000 (emphasis added). While the terms are helpful and encouraged, FDA requires more detailed statements regarding the "plant source" to inform consumers and help identify the food.

86. Motif uses the term "plant-based" to describe its products. The NSF is the exclusive certifier for the "Plant Based Foods Association" program. While I am unsure whether Motif is certified, the fact that Motif is using this term indicates that it is aware of the criteria for a food to be "plant based." As indicated on the NSF site, to be eligible for the certification, the foods cannot "contain any *animal-derived* ingredients." Ex. D (emphasis added).

87. The original source of the genomic sequence and the host in which it is made can be different in genetically modified organisms, but the papers cited by Dr. Batt do not tell a food scientist how the term "non-animal" should be interpreted in the context of the patents. Batt

Decl., ¶ 108. In my opinion, Dr. Batt and Motif are looking to outside sources and ignoring the focus and language of the patents.

88. Specifically, the '306 patent defines advantages of the invention, including "using no animals *in the production* of the consumable." '306 patent at 8:50-51 (emphasis added). Additionally, in the prosecution of one of the applications that later resulted in this family of patents, the '211 Application, as Dr. Batt points out, claims 167 and 168 defined the "protein content is *derived from* a non-animal source." Batt Decl., ¶ 61 (emphasis added). That "non-animal source" was then identified as a "genetically modified yeast." Therefore, a genetically modified yeast producing a protein is a "non-animal source." *Id.*

89. Furthermore, the applicant specifically added the term "free of animal heme-containing proteins" during the prosecution of the '241 patent and clarified in the response to the Examiner that "there would be no reason for Hsieh to modify their meat analog to contain heme *from a non-animal source*," such as the genetically modified yeast. Ex. 18[2] at IF_0013133 (emphasis added).

90. Dr. Batt also seems focused on a particular amendment made by the examiner in the prosecution of the '306 patent and the fact that the protein "myoglobin" was deleted and the phrase "non-animal" was added before the "heme-containing protein" in the proposed claim language. I understand the examiner identified this as a "clarifying amendment" while at the same time deleting "contains no animal products" from the claim. I would not understand such an amendment to change the substantive meaning of the claim.

[2] "Ex." numbers 12-25 are attached to Plaintiff Impossible Foods' Reply Claim Construction Brief.

B. Term Nos. 15-17: Replica

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
15	"muscle replica"	'761 patent claim 1	Plain and ordinary meaning. If the Court decides construction is necessary, this term should be construed to exclude the actual material being replicated or approximated.	"a composition, separate from other replicas, that mimics key features of muscle before or after cooking; the composition may be partially derived from animal sources"
16	"fat tissue replica"	'761 patent claim 1	Plain and ordinary meaning. If the Court decides construction is necessary, this term should be construed to exclude the actual material being replicated or approximated.	"a composition, separate from other replicas, that mimics key features of fat tissue before or after cooking; the composition may be partially derived from animal sources"
17	"wherein said muscle replica and fat tissue replica are assembled in a manner that approximates the physical organization of meat"	'761 patent claim 1	Plain and ordinary meaning. If the Court decides construction is necessary, this term should be construed to exclude the actual material being replicated or approximated.	Indefinite. To the extent the Court construes this term: "the muscle replica and fat tissue replica are combined to mimic the appearance of meat, and are visually distinguishable from each other after being combined"

91. Impossible argues that the terms "muscle replica" and "fat replica" should have their ordinary meaning and do not require construction. I agree.

92. I understand that Motif argues that the term "muscle replica" should mean "a composition, separate from other replicas, that mimics key features of muscle before or after cooking; the composition may be partially derived from animal sources." I further understand that Motif argues that "fat tissue replica" should mean "a composition, separate from other replicas, that mimics key features of fat tissue before or after cooking; the composition may be partially derived from animal sources."

93. If construction is necessary, I believe that the terms that include "replica" should not be understood to include animal muscle for the term "muscle replica" or animal fat for the term "fat tissue replica." In other words, a replica is not the thing that it replicates. Animal muscle tissue is not a "muscle replica." Animal fat tissue is not a "fat tissue replica."

94. My understanding of terms 15 and 16 is based on my understanding as a POSA in light of reading the '761 patent specification. For example, the specification provides an understanding of "muscle replica": "[T]he present invention provides a composition derived from non-animal sources which replicates or approximates key features of animal skeletal muscle. In another aspect, the present invention provides a meat substitute product that comprises a composition derived from non-animal sources which replicate or approximates animal skeletal muscle. Such a composition will be labeled herein as 'muscle replica.'" '761 patent at 25:35-42. Therefore, the specification informs me that the patent does not define a "muscle replica" as including the animal-derived skeletal muscle or animal derived tissues.

95. Likewise, the specification labels a "fat replica" as "a composition derived from non-animal sources which recapitulates key features of animal fat." '761 patent at 27:10-17. Therefore, I understand that the patent claims do not intend "fat tissue replica" to include animal fat or animal derived tissues.

96. The "muscle replica" could contain a "heme-containing protein" including animal myoglobin such as bovine, boar, or horse myoglobin. *See supra*, ¶¶ 79-80; '761 patent at 37:46-47 ("In some embodiments the consumable is a plant based meat that has animal myoglobin added."), 37:58-67. The term "animal myoglobin" would be redundant if Motif's terminology were adopted. Moreover, claim 12 of the '761 patent requires "no animal products," and would thus exclude these "animal myoglobin" proteins under Motif's definition.

97. I disagree with Dr. Legako that the specification that recites, for example, "In some embodiments, the muscle replica and/or meat substitute product comprising the muscle replica are partially derived from animal sources" means that animal muscle can be incorporated into the invention. Legako Decl.[3], ¶¶ 102-104. The specification gives an example of saving and recycling blood from animal farming, isolating the hemoglobin, and using it as the iron-carrying protein in the invention. '761 patent at 37:58-67. Although components of the muscle replica could be derived from an animal source, *i.e.* animal blood, the intended use of the "iron-containing protein" in this product would be as a coloring or flavoring agent, and the muscle tissue itself is not incorporated into the muscle replica.

98. The excerpts cited by Dr. Legako (Legako Decl., ¶¶ 101-103) from the '761 specification do not change my opinion that the "replica" does not include the thing itself which it seeks to replicate. In fact, the specification separately names products based in "meat" but supplemented with non-animal ingredients as "meat products": "the invention provides ***meat products*** substantially derived from animal sources but which are supplemented with one or more of a muscle tissue replica, a fat replica, and/or a connective tissue replica, wherein said replicas are derived substantially or entirely from non-animal sources." '761 patent at 23:8-14 (emphasis added).

99. I disagree with Dr. Legako's reference to "imitation crab." Legako Decl., ¶¶109-111. I do not think this analogy, which nowhere uses the term "replica," extends to the claim language here. In fact, the patent cited by Dr. Legako, Exhibit L7[4], does not use the term "replica" at all. Nor does the packaging name it as a crab "replica." Additionally, the use of

[3] Declaration of Dr. Jerrad Legako in Support of Motif's Answering Claim Construction Brief (D.I. 122) ("Legako Decl.").

[4] D.I. 122-1.

King Crab Meat and extracts of crab as specified by the label given in the example is primarily intended to flavor the product given that the use level is 2% or less. Legako Decl., ¶ 38. At the specified use level (2% or less), the real crab contained in this product, simply does not meet a high enough proportion to have a functional role in creating a crab meat-like texture or the approximate physical organization of crab meat to support a "replica" of that meat.

100. In contrast to Dr. Legako's wholly unrelated example, the Patent Trials and Appeal Board determined the meaning of this term in light of these claims, and in the context of this patent and prosecution history. I understand the Patent Trials and Appeal Board determined that term "muscle replica" means "a composition approximating the taste, texture or color of an equivalent muscle tissue derived from an animal source; the muscle replica may include components derived from an animal source, but does not include muscle tissue itself" and determined that, in this context, "replica" "excludes the actual material being replicated or approximated." D.I. 106-1, Ex. 6 at 9.

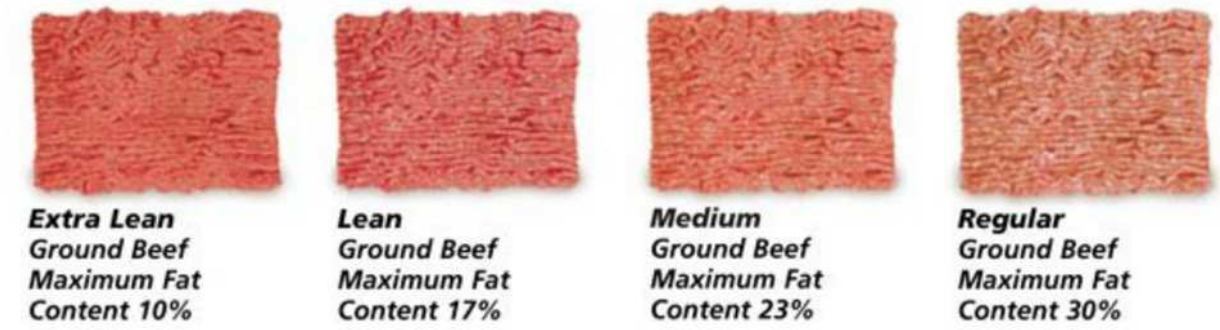
101. With respect to term 17, I agree with Impossible that the term "wherein said muscle replica and fat tissue replica are assembled in a manner that approximates the physical organization of meat" should also be interpreted to have its ordinary meaning.

102. I disagree with Motif in its opinion that term 17 does not have meaning within the scope of this claim. I also disagree with Motif's proposed definition, "the muscle replica and fat tissue replica are combined to mimic the appearance of meat, and are visually distinguishable from each other after being combined."

103. The specification of the '761 patent tells a person in the field how to understand the "physical organization of meat." For example, "[t]he physical organization of the meat substitute product can be manipulated by controlling the localization, organization, assembly, or

orientation of the muscle, fat, and/or connective tissue replicas described herein." '761 patent at 23:24-27. The patent goes on to provide examples of the "physical organization": "In an example embodiment, the replicas are combined in a manner that approximates the physical organization of natural ground meat. In other embodiments, the replicas are combined in a manner that approximates different cuts of beef, such as, e.g. ribeye, filet mignon, London broil, among others." *Id.* at 23:36-41. A POSA would understand that example to mean that the different tissue replicas would be incorporated together in such a way as to look, feel, and behave in the same way as meat products as is specified in the claims of the '761 patent.

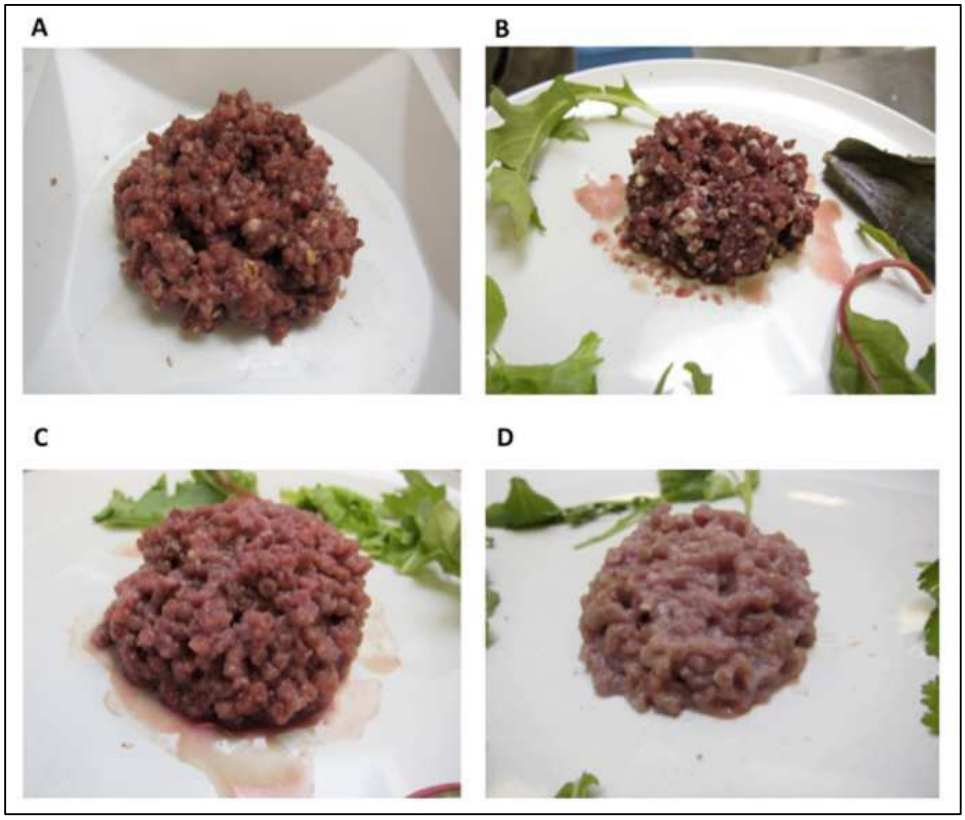
104. I disagree with Motif's hyperfocus on the visual aspect of the "physical organization." In the example of ground meat (below), a person of skill would understand that extra connective tissue and fat may be trimmed before grinding, and, generally, the ground meat may not have visually distinguishable fat, skeletal muscle, and/or connective tissue, especially as the percentage of fat in the sample is reduced.



available at https://www.fairhavenfarm.ca/beef/beef-cooking-tips.

105. The ground beef prototype patties in the examples, as depicted in Figures 15 and 16 do not necessarily provide visual separation of the skeletal muscle replica and the fat tissue replica. '761 patent, Figures 15-16. There are visual differences between panels A to D in Figure 15, but the formulations do not contain distinguishable fat, skeletal muscle, and/or connective tissue as is

similar for conventional ground meat products (*see* Figure ¶ 90, above). However, this does not mean that the beef replicas are "homogenous" as suggested by Dr. Legako. Legako Decl., ¶ 119. These examples do include both muscle replica and fat tissue replica. '761 patent at 46:22-45. The specific differences in the formulations are described in '761 patent. *See id.* at 17:49-65, 46:22-45.



106. Furthermore, the patent discusses other "physical characteristics" related to the "physical organization" of the meat replica, including the texture or "physical strength" of the product. '761 patent at 21:34-42. For instance, the patent describes testing "the force required to pierce a 1 inch thick structure (e.g. a patty)" and comparing it to the "the force required to pierce a 1 inch thick similar meat structure (e.g. a ground beef patty)." *Id.* It is common in the food science industry to use peak force measurements recorded by scientific instruments (texture analyzer) as an analogous procedure for sensory texture assessment.

107. While one aspect of the "physical characteristics" is the visual aspect, I disagree with Dr. Legako that the visual aspect is the *only* characteristic described in the '761 specification. For example, the patent discusses and gives examples of ground meat replicas, where a POSA would recognize that the normal organization of muscle tissue is disrupted when the muscle tissue (and cellular structure) from any animal is ground. However, a ground beef patty still has other physical characteristics, including the texture and feel of ground meat. While ground meat products have the cellular structure disrupted, there are physical characteristics associated with those products, which by regulatory definition are defined by their standard of identity as raw meat products in part 319 of the Code of Federal Regulations. Moreover, I believe a POSA would understand with reasonable certainty the full scope and meaning of the phrase "physical organization of meat" since the patent subsequently discusses the muscle, fat, and connective tissue replicas which are the major components of animal ground meat.

108. Dr. Legako discusses what he refers to as the "muscle ultrastructure." This is not a term regularly used by food scientists and generally refers to structures that require a microscope to be able to distinguish. The physical attributes of muscle, fat, and connective tissue, including the look and "feel" of it, are not generally understood as "ultrastructure" in the industry.

109. I also disagree with Dr. Legako's interpretation of the statements made in Impossible's IPR response. Legako Decl., ¶¶ 120-121. For instance, the response indicated that the reference, McMindes, instead of creating a fat tissue replica and a muscle replica, mixed all of the ingredients together at the same time to create a homogenous product. In fact, the term "homogeneous" was derived from the McMindes reference: "[T]he contents are mixed until a homogeneous mass of a soy protein containing food product is obtained." D.I. 122-3, Ex. L20 at

33-34 (citing McMindes, 107, 112). The claim itself requires a muscle replica and a fat replica be "assembled in a manner that approximates the physical organization of meat." However, Dr. Legako imparts some additional restrictions to the term such that the replicas must be visually distinguishable. I do not agree with this definition.

110. Therefore, I understand the phrase "wherein said muscle replica and fat tissue replica are assembled in a manner that approximates the physical organization of meat" would have reasonable certainty to a POSA and to have its plain meaning, for example to impart similar physical characteristics such as the look, feel, and texture of meat to the meat replica.

C. Term Nos. 21: Molarity

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
21	"a concentration of at least 1.5 mM"	'241 patent, claim 1	Plain and ordinary meaning with patentable weight for patentability purposes.	in a liquid composition having a concentration of at least 1.5 mM No patentable weight for patentability purposes; only has patentable weight for infringement since a product by process claim.

111. The claim covers "a meat-like-food product" produced by a method of combining plant proteins with (1) a heme containing protein, a sugar (lists specific sugars), and a sulfur compound (lists specific compounds) in this concentration.

112. I disagree with Dr. McGorrin that the term "a concentration of at least 1.5 mM" means the sulfur compounds need to be in a liquid composition with a concentration of at least 1.5 mM that is being separately added to the product. In my opinion, this is adding additional restrictions that are not warranted by the ordinary meaning of the term to a POSA, in light of the patent.

113. A food scientist (and indeed anyone who has taken even a general chemistry course in college) is able to calculate the molarity of a composition, which is nothing more than

the concentration of a chemical species within a particular solute as represented by moles (a mole is approximately 6.022 x 10^{23} molecules) per liter. In this case, the mM is 0.0015 moles/liter. This number can be calculated from other units of concentration, for example grams/liter and is nothing more than a representation of the concentration.

114. A food scientist would be able to take a sample of the product, including a non-liquid meat-like-food product, prepare it by extracting the compounds of interest, and test it with a high-performance liquid chromatography ("HPLC") or gas chromatograph ("GC") with a suitable detector to determine what is in the sample, and how much. The results would tell a food scientist how much cysteine, cystine, thiamine, and/or methionine would be present in the sample, usually in units of mg/mL. A person of skill would be able to convert the units from the HPLC or GC into mM units to determine how much of a compound is in the final sample.

115. A food scientist would understand that, as taught by the patent and the prosecution history, the concentration of the sulfur compound in the assembled product (before cooking) is what determines whether enough is present to generate the necessary reactions. The patent backgrounds tests for the flavors generated by particular amino acids ('241 patent 26:26-57 (Example 8)). The samples contain a certain concentration of the compounds, which were tested and evaluated by GC-MS and a trained sensory panel. *Id.* Examples 9 and 10 (*id.* at 26:59-29:25), similarly test different aspects of the flavor, again in a sample that is analyzed, so it is known how much precursor compound (i.e. sulfur compound) is needed to generate the desired flavors. A POSA would appreciate that this testing is done to demonstrate what levels or concentrations of the precursors are necessary to generate certain necessary flavors.

116. Additionally, Dr. McGorrin states that "the patent specifies only the molar concentration of the sulfur compound(s), and not how much of the sulfur compound(s) are added

to the claimed product . . . ." McGorrin Decl.[5], ¶ 25. This is because the inventors were indicating the concentration of the sulfur compounds in the assembled burger replicas, not in a solute being added: "Replica burgers *containing* the ingredients in Table 4 and the flavor precursors cysteine (10 mM), glutamic acid (10 mM), glucose (10 mM) and thiamine (1 mM) were prepared." '241 patent at 20:7-10. Table 4 indicates the amounts of the ingredients in terms of the percent (%) precooked weight ingredient per weight total (w/w). *Id.* at 20:36-53 (Table 4). A POSA would understand the ingredients are provided in the percent weight per weight to indicate the ratio of the ingredients, and the sugar and sulfur containing compounds were provided in the concentration of the assembled product so that the formulation could be replicated, regardless of scale.

117. Furthermore, Dr. Christopher Davis submitted a declaration in the prosecution of the '241 patent detailing the amino acid content of corn flour as used in the Proulx reference. Ex. 16 at IF_0012250 (¶¶ 5, 9). Dr. Davis found that the amino acids were present at a concentration of less than 0.9 mM total in the corn flour—a dry ingredient, not a solution. The analysis reported by Dr. Davis found that the "corn flour tortilla" from the Proulx reference did not contain at least 0.15 mM of free amino acids that contain sulfur, as required by the claims. *Id.* at IF_0012253 (¶ 27). Dr. Davis's declaration ultimately finds the "corn flour tortilla of Proulx" (*the final product*) did not contain the necessary *concentration* of sulfur-containing compounds. *Id.* The declaration demonstrates that the applicant contemplated that the *ingredients* would contribute the sulfur compounds, and that the amount would be measured *in the final product*.

[5] Declaration of Dr. Robert McGorrin in Support of Motif's Answer Claim Construction Brief (D.I. 121) ("McGorrin Decl.").

118. A food scientist understands that there needs to be a threshold amount in the food product being cooked in order to achieve a certain flavor. The inventors specified that the food product itself needs to have at least 1.5 mM of the sulfur-containing compounds. The amount would vary based on the size of the batch. This is why Table 4 indicates the amounts of the ingredients in terms of the percent precooked as w/w, or concentration in the assembled final product, not the respective amounts. Therefore, the *concentration* gives the critical information regarding how much of the sulfur-containing compound is needed in the assembled final product to achieve the desired flavor threshold.

D. Term Nos. 7-14: Limitations specifying compounds

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
7	"at least one sugar compound"	'761 patent, claim 1	Plain and ordinary meaning.	"sugar compound added as a flavor precursor to said muscle replica"
11	"at least one sulfur compound"	'761 patent, claim 1	Plain and ordinary meaning.	"at least one sulfur compound added as a flavor precursor to said muscle replica"
8	"a sugar selected from glucose, ribose, sucrose, fructose, xylose, maltodextrin, and combinations thereof"	'306 patent, claims 14 and 27 '250 patent, claims 1 and 13	Plain and ordinary meaning.	"glucose, ribose, sucrose, fructose, xylose, maltodextrin, or combinations thereof added as a flavor precursor to said meat replica matrix"
12	"at least one sulfur compound selected from methionine, cysteine and thiamine"	'306 patent, claims 14 and 27 '250 patent, claims 1 and 13	Plain and ordinary meaning.	"methionine, cysteine, and/or thiamine added as a flavor precursor to said meat replica matrix"
9	"a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose, and mixtures of two or more thereof"	'096 patent, claim 1 '241 patent, claim 1	Plain and ordinary meaning.	"glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose, or mixtures of two or more thereof added as a flavor precursor to said [food flavor additive composition

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
				('096 patent) / meat-like food product" ('241 patent)]
13	"a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof"	'096 patent, claim 1 '241 patent, claim 1	Plain and ordinary meaning.	"cysteine, cystine, thiamine, methionine, or mixtures of two or more thereof added as a flavor precursor to said [food flavor additive composition ('096 patent) / meat-like-food product ('241 patent)]"
10	"one or more of glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose"	'241 patent, claim 22	Plain and ordinary meaning.	"glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and/or galactose added as a flavor precursor to said meat-like-food product"
14	"one or more of cysteine, cystine, thiamine, and methionine"	'241 patent, claim 22	Plain and ordinary meaning.	"cysteine, cystine, thiamine, and/or methionine added as a flavor precursor to said meat-like-food product"

119. I understand that Motif relates all of the above terms to the same issue and includes the term "flavor precursor" in each definition.

120. Impossible believes that each of these terms should be given its ordinary meaning. I agree that each of these terms would be understood by a food scientist to have its ordinary meaning and terms 7-14 do not need to be further defined. I believe that each of these terms should be interpreted similarly across the patents, and the support below should apply to each of the patents, despite the fact that there are three different "sets" of patents.

121. Each of the claim terms has a plain meaning in the patents and a food scientist would not need further interpretation. I disagree with Dr. McGorrin and Motif, who believe each needs to 1) be added as an individual component instead of as a part of another ingredient and 2) serve a particular purpose, *i.e.* as a "flavor precursor." It is common for ingredients in food

products to have multiple roles/functions, and I see the ingredients in this food product doing the same.

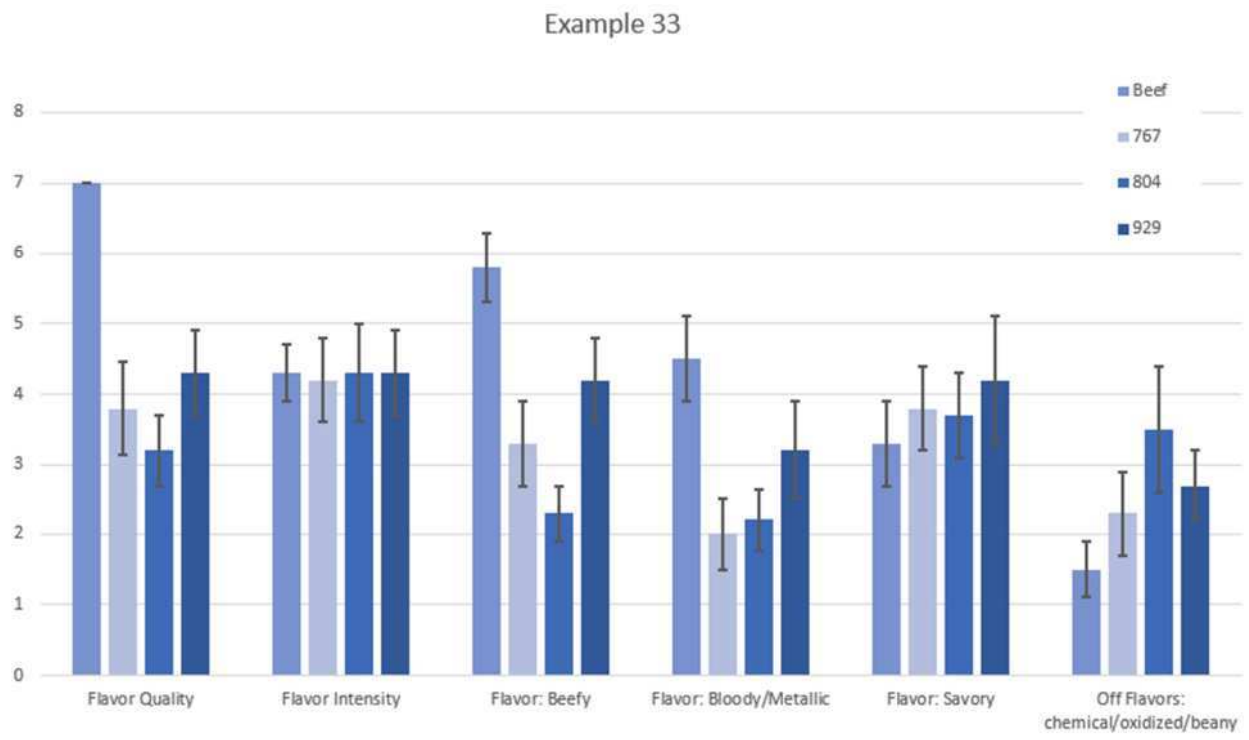
122. To begin, I note that none of the "compound" terms require that the compound be separately added or that they are added for a solely specific purpose, including that of a "flavor precursor." In my opinion, Motif and Dr. McGorrin are taking the plain meaning of each of the compound terms and inserting additional requirements for each term. Sugar and amino acids can serve other purposes in a food product, including adding nutritional content and color. The Maillard reaction, which is a common reaction that occurs when cooking food, gives color as well as imparting aroma and flavor, and that is why it is also known as "Maillard browning."

123. I understand Motif believes term 7 should mean "sugar compound added as a flavor precursor to said muscle replica." To start, I note that Motif's definition for term 7 fails to account for the "at least one" phrase in the claim language. Further, the term "flavor precursor" does not appear anywhere in the '761 patent. The "Constructing a Muscle Tissue Analog" section describes preparation of a muscle replica composition that contains plant proteins and other ingredients but does not "add" a sulfur compound to the muscle replica. '761 patent at 44:6-45:2. Therefore, I disagree with Motif's definition that requires the sugar compound or the sulfur compound be "added as a flavor precursor."

124. The '306 patent and the '250 patent have the same specification. These patents discuss the role of flavor precursors in food products, and Example 33 notes that "[c]haracteristic flavor and fragrance components in meat are mostly produced during the cooking process by chemical reaction molecules (precursors) including amino acids, fats and sugars ***that are found in plants as well as meat***." '306 patent at 84:9-12 (emphasis added). A POSA would understand this to mean that these molecules of amino acids, fats, and sugars—also called

precursors in the patents—could be derived from plants, or plant ingredients that have intended uses other than flavor. They do not need to be isolated and added separately.

125. I disagree with Dr. McGorrin's interpretation of Example 33 of the '306 patent. First of all, Example 33 noted that it created three replicas and compared them to 80:20 beef. '306 patent at 84:15-18. While the experiment noted that adding supplementary "flavor precursors" to two of the replicas "increased the beefy flavor, the bloody notes, overall flavor quantity, and decreased the off notes in the replica," the "beefy" flavor was within the standard deviation for one of the replica burgers. While the burgers were compared, I do not believe that the replica burger without the supplementary flavor precursors should be excluded or was meant to be merely a control. It is my opinion that the sample without the added precursors likely contains at least two volatile compounds associated with a beef-like aroma. Using the numbers from the table, I created a chart to visualize this data (below). The chart demonstrates that while the 767 and 929 samples, which contained the additional precursors, scored better in many areas, the 804 sample, which did not contain added precursors, but sugars and sulfur containing compounds from the ingredients, scored well in the flavor intensity and savory flavor categories, and scored better than one of the other samples in the bloody/metallic taste category.

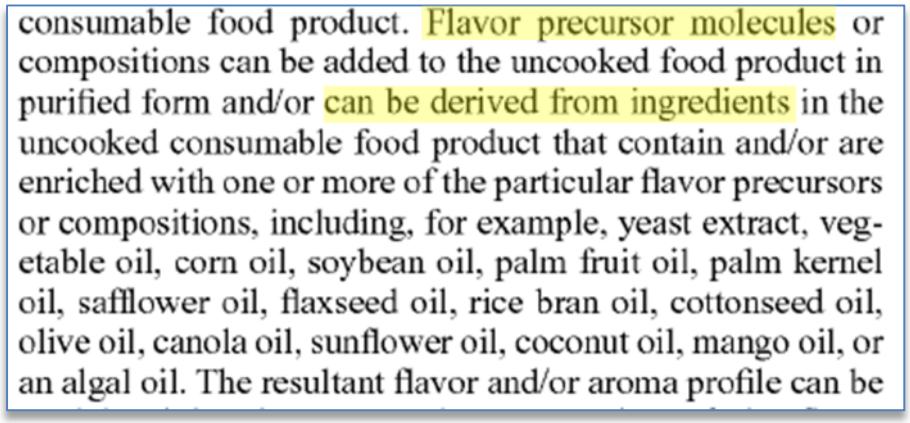


126. The '306 and '250 patents note that sugars, when combined with other ingredients, can help produce characteristic flavor and fragrance components of meat. '306 patent at 47:62-65. However, Example 16 describes the preparation of meat replicas that do not "add" the sugar compounds separately. *Id.* at 71:47-73:58. Instead, these sugars are contained in the ingredients, created from the meat tissue replica of Example 2, the fat tissue replica of Example 7, and the connective tissue replica of Example 14. None of these other examples contain any "added" sugar or sulfur compound. Additionally, while the other examples, such as Example 21 (*id.* at 77:28-67), include a "flavor precursor mix" that combines several ingredients, the patent notes that these compounds may be found in plant materials as noted above. '306 patent at 84:9-12.

127. The '096 and the '241 patent share the same specification as well. I understand Dr. McGorrin believes that Table 1 of the '241 specification indicates that the sugar and sulfur compounds cannot be part of the plant proteins because the list does not include proteins, rather amino acids and hydrolysates. McGorrin Decl., ¶ 68. I believe Dr. McGorrin is not putting

Table 1 into the context with the rest of the specification, which states that suitable flavor precursors can be, among other things, "organic molecules," which would include proteins which can be hydrolyzed through processing and further catalyzed by heating. Moreover, the plant proteins after processing (i.e. protein concentrate) will contain certain amounts of free amino acids and sugars, as required by the claims. '241 patent at 8:28-34.

128. Moreover, Dr. McGorrin's interpretation of these terms blatantly ignores the express teaching in the specification that the molecules do not need to be separately added but can be contained in the ingredients:


consumable food product. Flavor precursor molecules or compositions can be added to the uncooked food product in purified form and/or can be derived from ingredients in the uncooked consumable food product that contain and/or are enriched with one or more of the particular flavor precursors or compositions, including, for example, yeast extract, vegetable oil, corn oil, soybean oil, palm fruit oil, palm kernel oil, safflower oil, flaxseed oil, rice bran oil, cottonseed oil, olive oil, canola oil, sunflower oil, coconut oil, mango oil, or an algal oil. The resultant flavor and/or aroma profile can be

'241 patent at 2:55-64.

129. During the prosecution of the '241 patent, the examiner issued rejections over references where the sugar and sulfur containing compounds were included in *ingredients*, not separately added. Ex. 17 at IF_0013047 ("[B]eef is known to comprise; (1) the free amino acids, cysteine, cysteine, and methionine (p. 125/Table 1); and (b) the reducing sugars, glucose, glucose-6-phosphate, fructose and ribose (p. 126/Table 2).")). While the examiner did not specifically reference the amount of the sulfur compounds, the examiner appreciated that the compounds would be attributed to the beef source. In response to these rejections, the applicant amended the claims to provide that the product "is free of animal heme-containing protein" and

argued that the claims could not read on a reference, Hsieh, which "include[d] meat (i.e. beef), and relies on Dinh as evidence that beef comprises free amino acids, cysteine, and methionine, as well as reducing sugars, glucose, glucose-6 phosphate, fructose, and ribose." Ex. E at IF_0013173, 182. Notably, at no point did the applicant argue that these references were not applicable because the claims now required the compounds be separately or independently added as part of a solution.

130. I disagree with Dr. McGorrin's interpretation of the patent specification that plant proteins taste "planty" and nothing suggests that plant proteins are used as flavor precursors. McGorrin Decl., ¶ 69. Although plants generally contain less saturated fat and are more prone to oxidation, which contributes to "off flavors," such flavors can develop for many reasons. The portions of the '306 patent cited by Dr. McGorrin support my understanding that the plant proteins would contribute the sugar and sulfur compounds and are not required by the patent to be separately added. For instance, the '306 patent at 13:52-56 states that LOX (lipoxygenases, a type of enzyme) can appear when legume flours are fractionated into separate protein fractions. The patent includes this statement because it contemplates using legume flour that has been fractionated as a source of the sulfur compounds. The other sections cited by Dr. McGorrin in the '306 patent specifically tell a food scientist how to remove any off flavors that are associated with LOX. '306 Patent at 87:19-46 ("Removal of Off-Flavors from Pea Proteins using the Ligand Modified LOX Removal Resin"), 87:47-62 ("Reduction of Off-Flavors Using Antioxidants and/or LOX Inhibitors"), 71:47-73:58 (Example 16 ("Preparation of Meat Replicas in which the Particle Size of Individual Tissue Replica Units is Varied to Control Aroma Generation During Cooking")), 86:1-88:18 (Example 34 ("Removal of Off-Flavors from Plant Protein Solutions")).

131. Furthermore, Dr. Christopher Davis submitted a declaration during prosecution detailing the amino acid content of corn flour as used in the Proulx reference. Ex. 16 at IF_0012250 (¶¶ 5, 9). Dr. Davis found that the amino acids were present at a concentration of less than 0.9 mM total in the corn flour—a dry ingredient, not a solution. The analysis reported by Dr. Davis found that the corn flour tortilla (the final product) from the Proulx reference did not contain at least 0.15 mM of free amino acids that contain sulfur, as required by the claims. The analysis itself, however, shows that both the examiner, who issued the rejection that the declaration was used to overcome, and the inventors contemplated that the ingredients would contribute the sugar and sulfur compounds to the final product, and that they do not need to be isolated and separately added.

E. Term Nos. 23-25: Aroma

No.	Claim Term	Patent / Claim	Impossible's Proposed Construction	Motif's Proposed Construction
23	"A method for making a meat replica matrix having a beef-like aroma"	'306 patent, claims 14 and 27	Preamble is limiting. Plain and ordinary meaning.	Not limiting. If limiting, indefinite.
24	"meat-associated aroma"	'096 patent claim 1 '241 patent, claims 1 and 22	Plain and ordinary meaning.	Indefinite.
25	"beef-like aroma"	'306 patent claims 14 and 27 '250 patent, claims 1 and 13	Plain and ordinary meaning.	Indefinite.

132. I agree with Impossible that the term "[a] method for making a meat replica matrix having a beef-like aroma" should be given its normal meaning.

133. I understand Motif believes, and Dr. Legako asserts, "[a] method for making a meat replica matrix having a beef-like aroma" would not be understood to have a definite meaning by a food scientist. I disagree.

134. I believe Motif's and Dr. Legako's failure to understand these terms stems from the failure to put the words in the context of the claims, the entirety of the specifications of the patents, and the prosecution history. I believe that a POSA that read the entirety of the patents would with reasonable certainty be able to make the products discussed in the patents. I believe when the terms are taken out of context, then there could be misinterpretation. When one focuses on a specific word or results in a table but fails to read the body of the patent that describes the invention, then perhaps when that word or result is taken out of context there could be an alternate interpretation, which I believe could be the case in Motif and Dr. Legako's understanding of these inventions. I understand that, to show that a claim is indefinite, Motif must show that the boundaries of the claim do not have *reasonable* certainty. A POSA would readily understand the terms "meat-associated aroma" and "beef-like aroma" in the context of these claims.

135. Dr. Legako seems to take issue with the qualifiers in the terms "meat-*associated* aroma" and "beef-*like* aroma." In my opinion, a food scientist would understand that these aromas correspond to "meat aroma" and "beef aroma," respectively, but are qualified because the subject matter of the invention is a plant-based consumable.

136. Dr. Legako also takes issue with some of the terms used to describe the meaty or beefy aroma by the patent and the sensory olfactory analysis. A person of skill, and indeed a lay person, would be able to imagine a "beefy" smell. But in order to provide a more nuanced analysis, trained experts can distinguish attributes of other aromas within a food product that

contribute to the overall aroma. This is why there are descriptions of, for example, "fatty or creamy," "nutty and roasted," "earthy or mushroom," and "green, vegetable, or grass aromas" notes when isolating the individual molecules. '241 patent at 35:25-37:19.

137. Claims 14 and 27 of the '306 patent each recite "wherein, upon cooking of the meat replica matrix, at least two volatile compounds are generated that are associated with a beef-like aroma." Likewise, claims 1 and 22 of the '241 patent each recite "wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma."

138. Table 12 of the '241 and '096 patents contain a list of aromatic compounds found in beef by GC-MS. '241 patent at 30:35-35:24. A food scientist would understand how to test the samples by GC-MS after cooking (150 °C) to determine whether volatile compounds associated with a beef-like aroma or a meat-associated aroma are present. For instance, the '241 patent has a section labeled "Assessment of Food Products" and describes how trained panelists can evaluate food products, including for aroma. *Id.* at 18:63-19:67. The section describes using, among other things, human evaluations or GC-MS "to create an olfactory map of the food product" to assess how similar the cooked food is to meat. *Id.* at 19:40-46.

139. In addition to the disclosures in the patent specification, the file histories of the patents, including declarations from inventors and other food scientists, support this interpretation. Dr. Legako ignores the extensive declarations in the file history, including by Dr. Cadwallader, that indicate that a food scientist provided testimony to the patent office that the experimental approach and data analysis in the patents "are appropriate and acceptable for the purpose of evaluating and comparing aroma compound formation in the three reaction systems under heating conditions. It is also my opinion that these conditions which would simulate the

cooking of a 'ground beef-like food product' containing no animal products as described in the '006 application, and that the data obtained from the experimental approach would be reasonably predictive of the expected aroma compound formation from a 'ground beef-like food product . . . .'" Ex. 20 at IF_0012189 (¶ 14). For example, the Cadwallader Declaration submitted in the prosecution of the '241 Patent, the '096 Patent, and the '306 Patent discusses the 28 compounds identified in the Holz-Schietinger Declaration that were identified, and in particular two that are "important and potent odorants in cooked meat." *Id.* at IF_0012189-290 (¶ 15). Furthermore, Dr. Cadwallader states that making the products would result in "data obtained from the experimental approach would be reasonably predictive of the expected aroma compound formation from a 'ground beef-like food product.'" *Id.* at IF_0012189 (¶ 14).

140. Furthermore, the Lipman Declaration tests four heme proteins and explicitly sets forth, as also recited in Table 9 of the '479 application, "aroma compounds associated with a meaty aroma upon heating":

Table 9 of the '479 Application

Name	LegH	Barley	*B. myoglobin*	*A. aeolicus*
Furan	x	x	x	x
Thiazole	x	x	x	x
benzaldehyde	x	x	x	x
2-acetylthiazole	x	x	x	x
2-methyl-propanal	x	x	x	x
furfural	x	x	x	x
2,3-butanedione	x	x	x	x
2-pentyl-furan	x	x	x	x
2-pentanone	x	x		
pyrazine	x	x	x	x
dimethyl trisulfide	x	x	x	x
3-methyl-butanal	x	x		x
2-methyl-thiazole	x	x	x	x
pentanal	x	x	x	x
1,3,5-cycloheptatriene	x	x	x	x
methacrolein	x	x	x	x
heptanal	x	x	x	x
2-methyl-butanal	x	x		x
isothiazole	x	x	x	x
thiophene	x	x	x	x
propanal	x	x	x	x
2-heptenal	x		x	x
methyl-pyrazine	x	x	x	x
1-octene	x		x	x
butanal	x	x	x	x
2-acetyl-propen-2-ol	x	x	x	x
pyrrole	x	x	x	x
2-methyl-furan	x	x	x	x
nonanal		x	x	x
2-propenal		x	x	x
2-decenal		x	x	x
2-nonanone		x		x
2-octanone		x	x	x
2-tridecen-1-ol,			x	x
2-octanone			x	
2-octenal			x	x
4-methyl-2-heptanone			x	x
octanal			x	x
2-undecenal				x
butyrolactone				x
1-octen-3-one				x
3-methylheptyl acetate				x
2-pentyl-thiophene				x

Ex. 21 at IF_0012302 (¶ 14). While this is not an exhaustive list, a POSA would recognize that the compounds have been associated with "beef-like aroma" or "meat-associated aroma" and so would reasonably understand their meanings in the context of the patents.

141. Additionally, while many relevant compounds are explicitly identified in the prosecution history, other evidence, including a chapter written by the author of the article repeatedly cited by Dr. Legako, Glesni MacLeod, supports my opinion that a POSA would have a reasonable understanding of compounds with a "meaty aroma":

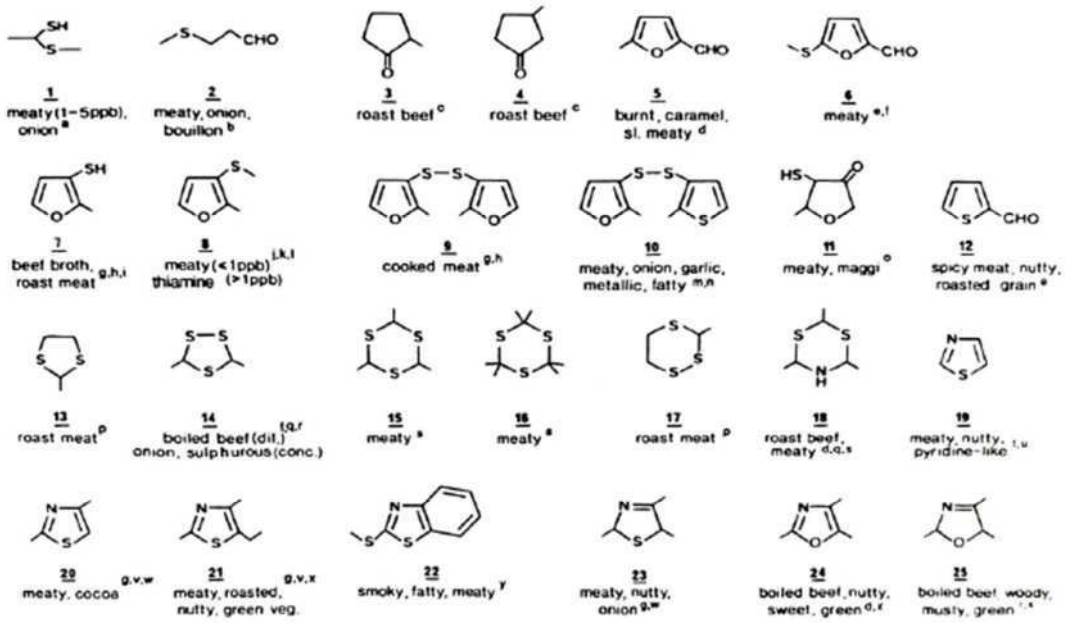


Figure 3.1 Compounds identified from cooked beef aromas (Maarse and Vischer, 1989; Werkhoff *et al.*, 1989, 1990) and reported to possess meaty odour ([b]Arctander, 1969; [f]Baltes, 1979; [e]Brinkman *et al.*, 1972; [h]Evers *et al.*, 1976; [o]Furia and Bellanca, 1975; [i]IFF Inc., 1979; [g]Katz, 1981; [q]Kubota *et al.*, 1980; Macleod, 1986; [j]MacLeod and Ames, 1986; [s]Mussinan *et al.*, 1976; [t]Nishimura *et al.*, 1980; [d]Ohloff and Flament, 1978; [u]Pittet and Hruza, 1974; [r]Roedel and Kruse, 1980; [l]Self *et al.*, 1963; [k]Shibamoto, 1980; [p]Tressl and Silwar, 1981; [n]Tressl *et al.*, 1983; [m]van den Ouweland and Peer, 1975; [v]van der Linde *et al.*, 1979; [a]Vernin, 1979, [x]1982; [w]Werkhoff *et al.*, 1989, [z]1990; [c]Wilson *et al.*, 1974).

Ex. F[6] at IF_0014028, Fig. 3.1 (emphasis added).

[6] G. MacLeod, "The flavour of beef," Flavor of Meat, Meat Products and Seafoods, 2nd Ed. (F. Shahidi ed.), Ch. 3 (Blackie Academic & Professional 1998)

142. Furthermore, Exhibit B to the August 17, 2017 Celeste Holz-Schietinger declaration details the results of the testing for the aroma compounds, grouped into eight classes of chemicals. The final column provides peer-reviewed publications in which that particular aroma compound is associated with meaty aroma. Ex. G at IF_0012169-170. Food scientists routinely characterize and classify aromas. That some of the compounds identified may also be associated or described as something other than "meaty" or "beefy" does not mean that a POSA does not know what is—and what is not—a "beef-like aroma" or a "meat-associated aroma."

143. Dr. Legako also takes issue with some of the terms used to describe the meaty or beefy aroma by the patent and the sensory olfactory analysis. A person working in the food science industry, and indeed a lay person, would be able to recognize a "beefy" or "meaty" smell. A reference cited by Dr. Legako, MacLeod, noted that certain isolated molecules gave off a "roasted, nutty, green, or earthy qualities," "fresh onions," or "bread crusts," which Dr. Legako claims "are not sufficiently beef like or 'meaty' for purposes of [the Macleod] study." Legako Decl., ¶ 128, citing D.I. 122-1, Ex. L6 at 356. I disagree with Dr. Legako that these would indicate that a food scientist would not know what is or is not "beef-like" or "meat-associated." Furthermore, in the book *Sensory-Directed Flavor Analysis*, Chapter 9 focuses on character-impact flavor compounds. Ex. 22. Dr. McGorrin writes "Sulfur-containing heterocyclic compounds are associated with meaty characteristics. Two compounds with the most potent meaty impact include 2-methyl-3-furanthiol (1 ppt) and the corresponding dimer, *bis*-(2-methyl-3-furyl) disulfide (0.02 ppt)." *Id.* at IF_0014086-087. These same two potent compounds are found in Table 14 of the '241 patent and were identified by GC-MS. '241 patent at 38:33-40:46. Additionally, the compounds that Dr. McGorrin describes as being character-impact flavor compounds in beef (below and highlighted for clarity) are found in Table 14 of the '241 patent.

Note that 4-methyl-5-thiazoleethanol is a synonymous with 4-methyl-5-(2-hydroxyethyl)thiazole. Overall, I find it highly unlikely that a POSA would not be able to comprehend the important flavor compounds in meat and beef flavor given the amount of research that exists on the subject.

Table 9.6 Character-Impact Flavor Compounds in Meats and Fish

Character-Impact Compounds	CAS Registry No.	Occurrence	Reference
Dimethyl sulfide	[75-18-3]	Clam, oyster	93
4-Methylnonanoic acid	[45019-28-1]	Lamb	87
4-Methyloctanoic acid	[54947-74-9]	Lamb	87
2-Pentylpyridine	[2294-76-0]	Lamb	87
2-Acetyl-2-thiazoline	[22926-41-8]	Roasty (beef)	88
2-Methyl-3-(methylthio)furan	[63012-97-5]	Roast beef	21
4-Me-5-(2-hydroxyethyl)thiazole	[137-00-8]	Roasted meat	18
2-Ethyl-3,5-dimethylpyrazine	[13925-07-0]	Roasty (beef)	89
2,3-Diethyl-5-methylpyrazine	[18138-04-0]	Roasty (beef)	89
2-Methyltetrahydrofuran-3-thiol	[57124-87-5]	Brothy, meaty	18
2-Methyl-3-furanthiol	[28588-74-1]	Meat, beef Canned tuna fish	21
Bis-(2-methyl-3-furyl) disulfide	[28588-75-2]	Aged, prime-rib	21
12-Methyltridecanal	[75853-49-5]	Beef, stewed	91
(*E,E*)-2,4-Decadienal	[25152-84-5]	Chicken fat	18
2,5-Dimethyl-1,4-dithiane-2,5-diol	[55704-78-4]	Chicken broth	18
2-Pyrazineethanethiol	[35250-53-4]	Pork	18
(*Z*)-1,5-Octadien-3-one	[65767-22-8]	Salmon, cod	96
(*E,Z*)-2,6-Nonadienal	[557-48-2]	Trout, boiled	97
Pyrrolidino-2,4-(Me_2)dithiazine	[116505-60-3]	Roasted shellfish	99
5,8,11-Tetradecatrien-2-one	[85421-52-9]	Shrimp, cooked	98
2,4,6-Tribromophenol	[118-79-6]	Shrimp, ocean fish	100

Ex. 22 at IF_0014087.

144. The references cited by Dr. Legako support my conclusion. The MacLeod reference reviews other studies in this review and looks at whether certain isolated compounds contribute to the "meaty" or "beefy" aroma in particular (including using the term in question

here, "beef-like aroma"). D.I. 122-1, Ex. L6 at 356-357 (noting that "few, if any, of these compounds have meaty aromas," "some phenols are the most important in meat flavor," none of them individually possessed meaty notes," "the neutral fraction was the only one to present a pleasant ***beef-like aroma***"). A review paper written to aggregate data from other papers and examine compounds that contribute to a "beef-like aroma" or "meat-associated aroma," strongly undermines Dr. Legako's claim that a skilled food scientist would not have a reasonable understanding of these terms.

145. In order to provide a more nuanced analysis, experts can detect traces or notes of other aromas within a smell that contribute to the overall aroma. This is why you get descriptions of, for example, "fatty or creamy," "nutty and roasted," "earthy or mushroom," and "green, vegetable, or grass aromas" notes when isolating the individual molecules. '241 patent at 35:25-37:19. A list of aromatic compounds found in beef by GC-MS is noted in Table 12 of the '241 and '096 patents. A skilled or trained expert would be able to identify which compounds contribute to the "beef-like aroma" or "meat-associated aroma" in the claims. A chapter entitled "The flavour of beef" in a textbook regarding the *Flavor of Meat, Meat Products and Seafoods* notes that the term "meatiness" can be "cleanly dissected sensorially into about ten different odour qualities (Galt and MacLeod, 1983), in which case, many of the identified volatiles are acting as 'aroma modifiers' contributing buttery, caramel, roast, burnt, sulphurous, green, fragrant, oily/fatty and nutty qualities." Ex. F at IF_0014026.

146. As Dr. Legako acknowledges, the '306 and '250 patents provide examples of "[b]eef flavor compounds" released upon cooking ('306 patent at 85:18-67 (Table 10);'250 patent at 85:1-44 (Table 10)). Moreover, the patent describes, and a POSA would understand,

how to test for such aroma profiles. For example, the patents describe that "[a]roma profiles of the samples were analyzed by a panel of testers, and by GC-MS." '306 patent at 72:9-10.

147. In fact, [redacted] A POSA is not only able to discern what may taste (or smell) "beef-like," but they can break it down much further into different preparations of beef and try to recreate characteristics of that smell and taste.

148. The terms "meat-associated aroma" or "beef-like aroma," when put in the proper context of the claims, the patent specification, and the file history, are easily understood by a POSA. I disagree with Motif that these terms are indefinite.

Dated: July 7, 2023

Paul J. Sarnoski, Ph.D.