

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Motif FoodWorks, Inc.

Petitioner,

v.

Impossible Foods Inc.

Patent Owner.

U.S. Patent No. 9,943,096

**“METHODS AND COMPOSITIONS FOR AFFECTING THE FLAVOR
AND AROMA PROFILE OF CONSUMABLES”**

Inter Partes Review No. 2023-00206

PETITIONER’S REPLY TO PATENT OWNER’S RESPONSE

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
II. GROUNDS 2A-2B: GIACINO, BROWN, MACLEOD RENDER THE CHALLENGED CLAIMS OBVIOUS.....	3
A. PO’s Arguments Are All Predicated on a Mischaracterization of the Petition and an Erroneous Inherent Obviousness Theory	3
B. The Reaction Factors/Conditions PO Identifies Are Therefore Irrelevant	8
C. The Petition Does Not Lack Particularity to Show Obviousness	10
D. Dr. Tarté’s Testimony Support’s Petitioner’s Obviousness Ground.....	11
E. PO’s Expert Concedes That Giacino Discloses Volatiles Having a Meat-associated Aroma	14
F. PO Fails to Rebut Petitioner’s Motivation to Combine and Reasonable Expectation of Success	15
1. Dr. McGorrin’s Unrelated “Plant Protein” Testimony Is Irrelevant	16
2. PO’s Lipid Oxidation Arguments Fail.....	17
3. Any Differences in Reaction Pathways Between Giacino and Brown Do Not Undermine Motivation to Combine	18
4. Any Differences in Structure Between Giacino and Brown Do Not Undermine Motivation to Combine	19
5. PO Does Not Rebut Petitioner’s Reasonable Expectation of Success.....	20
6. PO’s Arguments Fail to Consider That Claims 1-9, 24 Do Not Require Any Particular Aroma	21
III. GROUNDS 4A-4C: GIACINO, PROULX, PERRET, MACLEOD RENDER THE CLAIMS OBVIOUS	22
A. PO Did Not Dispute Key Facts	23
B. PO’s Objections Fail	24
IV. CONCLUSION.....	28

TABLE OF AUTHORITIES

	<u>Page</u>
<u>Cases</u>	
<i>AstraZeneca LP v. Breath Ltd.</i> , 603 Fed.Appx. 999 (Fed. Cir. 2015).....	4
<i>Intel Corp. v. PACT XPP Schweiz AG</i> , 61 F.4th 1373 (Fed. Cir. 2023)	26
<i>Intel Corp. v. Qualcomm Inc.</i> , 2022 WL 880681 (Fed. Cir. 2022)	25
<i>KSR Int’l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007).....	26
<i>Pfizer, Inc. v. Apotex, Inc.</i> , 480 F.3d 1348 (Fed. Cir. 2007)	16, 17, 20
<u>Other Authorities</u>	
37 C.F.R. §42.6(a)(3)	17

EXHIBIT TABLE

EX1001	U.S. Patent No. 9,943,096
EX1002	Prosecution History of U.S. 9,943,096
EX1003	Declaration of Rodrigo Tarté, Ph.D.
EX1004	Curriculum vitae of Rodrigo Tarté, Ph.D.
EX1005	Declaration of Robert McGorin, Ph.D.
EX1006	Curriculum vitae of Robert McGorin, Ph.D.
EX1007	Declaration of Carl Batt, Ph.D.
EX1008	Curriculum vitae of Carl Batt, Ph.D.
EX1009	Declaration of Sylvia Hall-Ellis, Ph.D.
EX1010	Curriculum vitae of Sylvia Hall-Ellis, Ph.D.
EX1011	Exhibits to Declaration of Sylvia Hall-Ellis, Ph.D.
EX1012	International Pub. No. WO 2013/010042 A1 to Brown et al., published January 17, 2013
EX1013	U.S. Patent No. 4,818,557 to Conrad, issued April 4, 1989
EX1014	U.S. Patent Publication No. 2011/0287467 A1 to Crane et al., published November 24, 2011
EX1015	U.S. Patent No. 3,519,437 to Giacino, issued July 7, 1970
EX1017	Mottram, <i>Flavour Formation in Meat and Meat Products: A Review</i> , 62 FOOD CHEM. 415-24 (1998)
EX1019	Proulx & Reddy, <i>Iron Bioavailability of Hemoglobin from Soy Root Nodules Using a Caco-2 Cell Culture Model</i> , 54 J. AGRIC. & FOOD CHEM. 1518-22 (2006)

EX1020	U.S. Patent No. 3,365,306 to Perret, issued January 23, 1968
EX1021	U.S. Patent Publication No. 2008/0268112 A1 to Rolan et al., published October 30, 2008
EX1022	U.S. Patent Publication No. 2008/0026128 A1 to Yamaguchi et al., published January 31, 2008
EX1024	MacLeod et al., <i>Natural and Simulated Meat Flavors (with Particular Reference to Beef)</i> , 14 CRITICAL REVIEWS IN FOOD SCI. & NUTRITION 309-437 (1981)
EX1025	U.S. Provisional No. 61/751,816, filed January 11, 2013
EX1026	Dwivedi & Brockman, <i>Meat Flavor</i> , 5 CRITICAL REVIEWS IN FOOD SCI. & NUTRITION 487-535 (1981)
EX1027	Pearson & Gillett, PROCESSED MEATS Ch. 3 (3d ed. 1996)
EX1028	Calkins & Hodgen, <i>A Fresh Look at Meat Flavor</i> , 77 MEAT SCI. 63-80 (2007)
EX1029	Williamson et al., <i>Red Meat in the Diet</i> , 30 NUTRITION BULLETIN 323-55 (2005)
EX1030	Garrocho-Villegas et al., <i>Plant Hemoglobins: What We Know A Six Decades after Their Discovery</i> , 398 GENE 78-85 (2007)
EX1031	McGorin, <i>The Significance of Volatile Sulfur Compounds in Food Flavors</i> , in VOLATILE SULFUR COMPOUNDS IN FOOD 3-31 (Qian et al., eds., 2011)
EX1032	Cerny & Davidek, <i>Formation of Aroma Compounds from Ribose and Cysteine during the Maillard Reaction</i> , 51 J. AGRIC. FOOD CHEM. 2714-21 (2003)

EX1033	Reineccius, FLAVOR CHEMISTRY AND TECHNOLOGY CH. 5 (2d ed. 2006)
EX1034	Reineccius, FLAVOR CHEMISTRY AND TECHNOLOGY CH. 9 (2d ed. 2006)
EX1035	Verbeke & Viaene, <i>Ethical Challenges for Livestock Production: Meeting Consumer Concerns about Meat Safety and Animal Welfare</i> , 12 J. OF AGRIC. & ENV'T ETHICS 141-51 (2000)
EX1036	Pimentel & Pimentel, <i>Sustainability of Meat-Based and Plant-Based Diets and the Environment</i> , 78 AM. J. CLINICAL NUTRITION 660S-63S (2003)
EX1038	Manley, <i>Process Flavors</i> , in SOURCE BOOK OF FLAVORS 139-54 (G. Reineccius ed., 2d ed. 1999)
EX1039	McGorrin, <i>Character-Impact Flavor and Off-Flavor Compounds in Foods</i> , in FLAVOR, FRAGRANCE, AND ODOR ANALYSIS 207-62 (R. Marsili ed., 2d ed. 2012)
EX1043	Dreher et al., <i>GC–Olfactometric Characterization of Aroma Volatiles from the Thermal Degradation of Thiamin in Model Orange Juice</i> , 51 J. AGRIC. FOOD CHEM. 3097-102 (2003)
EX1045	Hofmann & Schieberle, <i>Evaluation of the Key Odorants in a Thermally Treated Solution of Ribose and Cysteine by Aroma Extract Dilution Techniques</i> , 43 J. AGRIC. FOOD CHEM. 2187-2194 (1995)
EX1046	Goto et al., <i>Iron Fortification of Rice Seed by the Soybean Ferritin Gene</i> , 17 NATURE BIOTECH. 282-86 (1999)
EX1047	Zhu & Cadwallader, <i>Streamlined Approach for Careful and Exhaustive Aroma Characterization of Aged Distilled Liquors</i> , 3 Food Chem.: X 100038 (2019)
EX1048	Pearson & Gray, <i>Mechanism Responsible for Warmed-Over Flavor in Cooked Meat</i> , in THE MAILLARD REACTION IN FOODS AND NUTRITION 287-300 (Waller & Feather eds., 1983)

EX1049	Hofmann & Schieberle, <i>Quantitative Model Studies on the Effectiveness of Different Precursor Systems in the Formation of the Intense Food Odorants 2-Furfurylthiol and 2-Methyl-3-furanthiol</i> , 46 J. AGRIC. FOOD CHEM. 235-41 (1998)
EX1050	Jahreis et al., <i>Legume Flours: Nutritionally Important Sources of Protein and Dietary Fiber</i> , 63 ERNÄHRUNGS UMSCHAU INT’L 36-42 (2016) (Original German)
EX1051	Hofmann et al., <i>Model Studies on the Oxidative Stability of Odor-Active Thiols Occurring in Food Flavors</i> , 44 J. AGRIC. FOOD CHEM. 251-55 (1996)
EX1052	GRAS Notice No. 737: GRAS Notification for Soy Leghemoglobin Protein Preparation Derived from Pichia Pastoris, submitted by Impossible Foods Inc. (Oct. 2, 2017), <i>available at</i> https://www.fda.gov/media/124351/download
EX1056	Klesk & Qian, <i>Aroma Extract Dilution Analysis of Cv. Marion (Rubus spp. hyb) and Cv. Evergreen (R. laciniatus L.) Blackberries</i> , 51 J. AGRIC. FOOD CHEM. 3436-41 (2003)
EX1057	Krumina-Zemture et al., <i>Amino Acid and Dietary Fibre Content of Pea and Buckwheat Flours</i> , RESEARCH FOR RURAL DEVELOPMENT 2016 VOL. 1, 84-90
EX1059	Jahreis et al., <i>Legume Flours: Nutritionally Important Sources of Protein and Dietary Fiber</i> , 63 ERNÄHRUNGS UMSCHAU INT’L 36-42 (2016) (English Version)
EX1060	Marchand et al., <i>Possible Mechanism for Involvement of Cysteine in Aroma Production in Wine</i> , 50 J. AGRIC. & FOOD CHEM. 6160-64 (2002)
EX1064	Splivallo et al., <i>Bacteria Associated with Truffle-Fruiting Bodies Contribute to Truffle Aroma</i> , 17 ENV’T MICROBIOLOGY 2647-60 (2015)
EX1067	Meng & Cloutier, <i>Gelatin and Other Proteins for Microencapsulation, in MICROENCAPSULATION IN THE FOOD INDUSTRY</i> 227-39 (Gaonkar et al., eds., 2014)

EX1070	Karaca, <i>Nanostructured Proteins</i> , in FOOD STRUCTURE AND FUNCTIONALITY 181-200 (Galanakis ed., 2021)
EX1071	Flutto, <i>Pectin Properties and Determination</i> , in ENCYCLOPEDIA OF FOOD SCIENCES & NUTRITION 4440-49 (2d ed. 2003)
EX1072	Green, <i>Headspace Analysis Static</i> , in ENCYCLOPEDIA OF ANALYTICAL SCIENCE 229-36 (2d ed. 2005)
EX1073	Santana et al., <i>Evidence that the Plant Host Synthesizes the Heme Moiety of Leghemoglobin in Root Nodules</i> , 116 PLANT PHYSIOLOGY 1259-69 (1998)
EX1074	dos Santos & Grenha, <i>Polysaccharide Nanoparticles for Protein and Peptide Delivery: Exploring Less-Known Materials</i> , 98 Advances in Protein Chem. and Structural Biology 223-61 (2015)
EX1078	U.S. Patent No. 8,802,399 to Reutter-Maier et al., issued August 12, 2014
EX1079	U.S. Patent No. 6,218,168 to Leinfelder et al., issued April 17, 2001
EX1080	U.S. Patent No. 4,760,139 to Feniou et al., issued July 26, 1988
EX1081	U.S. Patent No. 8,609,890 to Hu, issued December 17, 2013
EX1083	Buffo & Han, <i>Edible Films and Coatings from Plant Origin Proteins</i> , in FOOD SCIENCE & TECHNOLOGY, INNOVATIONS IN FOOD PACKAGING 277-300 (2005)
EX1084	Fellows, FOOD PROCESSING TECHNOLOGY: PRINCIPLES AND PRACTICE Ch. 6 (3d ed. 2009)

EX1085	WACKER CHEMIE AG, <i>Fermopure – Plant-Based L-cystine and L-cysteine</i> (2021), available at https://www.wacker.com/cms/en-us/products/brands/fermopure/fermopure.html
EX1087	Williams, <i>Nutritional Composition of Red Meat</i> , 64 NUTRITION & DIETETICS: J. OF THE DIETITIANS ASSOC. OF AUSTL. S113 (2007)
EX1089	Yebra-Biurrun, <i>Food and Nutritional Analysis Sweeteners</i> , in ENCYCLOPEDIA OF ANALYTICAL SCIENCE (3d ed. 2013)
EX1093	Vauthey et al., <i>Structured Fluids as Microreactors for Flavor Formation by the Maillard Reaction</i> , 48 J. AGRIC. & FOOD CHEM. 4808-16 (2000)
EX1095	Withycombe & Mussinan, <i>Identification of 2-Methyl-3-Furanthiol in the Steam Distillate from Canned Tuna Fish</i> , 53 J. FOOD SCI. 658 (1988)
EX1096	Kerscher & Grosch, <i>Quantification of 2-Methyl-3-furanthiol, 2-Furfurylthiol, 3-Mercapto-2-pentanone, and 2-Mercapto-3-pentanone in Heated Meat</i> , 46 J. AGRIC. FOOD CHEM. 1954-58 (1958)
EX1098	Zyzak et al., <i>Investigation into the Sensorial and Analytical Differences of Traditional Hamburgers Versus the Plant-Based Analogues</i> , presentation at ACS Fall 2021, available at https://acs.digitellinc.com/acs/sessions/169689/view
EX1099	Mottram, <i>The Maillard Reaction: Source of Flavour in Thermally Processed Foods</i> , in FLAVOURS AND FRAGRANCES 269-83 (Berger ed., 2007)
EX1100	Ulrich et al., <i>Investigation of the Boiled Potato Flavor by Human Sensory and Instrumental Methods</i> , 77 AM. J. POTATO RSCH. 111-17 (2000)
EX1101	Protein Sequence BLAST Results, from NAT'L LIBR. MED.: BLAST, https://blast.ncbi.nlm.nih.gov/Blast.cgi
EX1106	<i>Peas, green, raw</i> , FoodData Central, U.S. DEP'T OF AGRIC., https://fdc.nal.usda.gov/fdc-app.html#/food-details/170419/nutrients
EX1107	<i>What Gives Meat its Color?</i> , EXPLORATORIUM: SCIENCE OF COOKING, https://www.exploratorium.edu/cooking/meat/INT-what-meat-color.html
EX1108	<i>Cystein</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/5862

EX1109	<i>Maltodextrin</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/Maltodextrin-dextrose-equivalent-10-15
EX1110	<i>Thiamine</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/1130
EX1111	<i>Ribose</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/D-Ribose
EX1112	<i>Sucrose</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/Sucrose
EX1113	<i>Organoleptic</i> , COLLINS, https://www.collinsdictionary.com/us/dictionary/english/organoleptic
EX1114	<i>Sniffing Out which Plant-Based Burgers Smell the Most Like Real Beef</i> , AM. CHEM. SOC'Y, https://www.acs.org/content/acs/en/pressroom/newsreleases/2021/august/sniffing-out-which-plant-based-burgers-smell-the-most-like-real-beef.html
EX1115	d'Estries, <i>Science Reveals Which Plant-Based Burger Smells Closest to the Real Thing</i> , TREEHUGGER, https://www.treehugger.com/science-reveals-plant-based-burger-smells-5200260
EX1116	Second Amended Complaint for Damages and Injunctive Relief, <i>Impossible Foods Inc. v. Motif Foodworks, Inc.</i> , Case No. 1:22-cv-00311-CFC, D.I. 22 (D. Del. Sept. 7, 2022)
EX1118	Wang et al., <i>Reinvestigation of 2-acetylthiazole Formation Pathways in the Maillard Reaction</i> , 345 FOOD CHEM. 128761 (2021)
EX1119	Boelens & Gemert, <i>Volatile Character-Impact Sulfur Compounds and Their Sensory Properties</i> , 18 PERFUMER & FLAVORIST 29-39 (1993)
EX1120	Adam McQueen, <i>Beyond Meat vs. Impossible Foods: The Very Real Battle Between the Biggest 'Fake-Meat' Competitors</i> , KLUE, https://klue.com/blog/beyond-meat-vs-impossible-foods-the-very-real-battle-between-the-biggest-fake-meat-competitors
EX1121	Pat Brown, <i>Heme, Health, and the Plant-Based Diet</i> , IMPOSSIBLE, https://impossiblefoods.com/blog/heme-health-the-essentials
EX1122	Saha & Bhattacharya, <i>Hydrocolloids as Thickening and Gelling Agents in Food: A Critical Review</i> , 47 J. FOOD SCI. & TECH. 587-97 (2010)

EX1123	<i>Meat Consumption</i> , OECD (2022), https://data.oecd.org/agroutput/meat-consumption.htm
EX1129	Mottram, <i>Volatile Compounds from the Reaction of Cysteine, Ribose, and Phospholipid in Low-Moisture Systems</i> , 43 J. AGRIC. FOOD CHEM. 984-88 (1995)
EX1130	Kang et al., <i>Gelation and Gel Properties of Soybean Glycinin in a Transglutaminase-Catalyzed System</i> , 42 J. AGRIC. FOOD CHEM. 159-65 (1994)
EX1131	Nio et al., <i>Gelation Mechanism of Protein Solution by Transglutaminase</i> , 50 AGRIC. & BIOLOGICAL CHEM. 851-55 (1986)
EX1132	U.S. Patent No. 4,153,738A to Ronai et al., issued May 8, 1979
EX1133	Hargrove et al., <i>Characterization of Recombinant Soybean Leghemoglobin a and Apolar Distal Histidine Mutants</i> , 266 J. MOLECULAR BIOLOGY 1032-42 (1997)
EX1134	Lund & Lorenz, <i>Influence of Time, Temperature, Moisture, Ingredients, and Processing Conditions on Starch Gelatinization</i> , 20 CRITICAL REVIEWS IN FOOD SCI. & NUTRITION 249-73 (2009)
EX1135	Nicola & Leach, <i>Structural Rearrangements Due to Ligand Binding and Haem Replacement in Myoglobin and Leghaemoglobins</i> , 78 EUROPEAN J. BIOCHEM. 133-40 (1977)
EX1136	Whistler & Daniel, <i>Carbohydrates</i> , in FOOD CHEMISTRY (O. Fennema, ed., 2d ed., revised and expanded, 1985)
EX1137	Batt et al., <i>Expression of Recombinant Bovine β-Lactoglobulin in Escherichia coli</i> , 54 AGRIC. & BIOLOGICAL CHEM. 949-55 (1990)
EX1138	Jamieson et al., <i>Cloning and Nucleotide Sequence of the Bovine β-Lactoglobulin Gene</i> , 61 GENE 85-90 (1987)
EX1139	Weed et al., <i>Is Hemoglobin an Essential Structural Component of Human Erythrocyte Membranes?</i> , 42 J. CLINICAL INVESTIGATION 581-88 (1963)
EX1141	Evers et al., <i>Furan Substituted at the Three Position with Sulfur</i> , in PHENOLIC, SULFUR, AND NITROGEN COMPOUNDS IN FOOD FLAVORS SYMPOSIUM 184-93 (1976)
EX1145	U.S. Provisional No. 61/908,634, filed November 25, 2013

EX1146	<i>Sniffing Out which Plant-Based Burgers Smell the Most Like Real Beef</i> (Video), AM. CHEM. SOC'Y, available at https://www.youtube.com/watch?v=3W_0GqGnsN4&list=PPSV
EX1147	T.L. Stanley, <i>Impossible Foods Hires a Veteran of Apple Ads to Beef Up its Creative Marketing</i> , ADWEEK, https://www.adweek.com/brand-marketing/impossible-foods-hires-a-veteran-of-apple-ads-to-beef-up-its-creative-marketing/#:~:text=Impossible%20Foods%20Hires%20a%20Veteran%20of%20Apple%20Ads,record.%20Impossible%20By%20T.L.%20Stanley%20April%202013%2C%202021
EX1148	Prosecution History of U.S. Patent No. 10,039,306 to Vrljic et al.
EX1149	Prosecution History of U.S. Patent No. 11,013,250 to Vrljic et al.
EX1150	Prosecution History of U.S. Patent No. 11,224,241 to Fraser et al.
EX1151	Ames, <i>Control of the Maillard Reaction in Food Systems</i> , 1 TRENDS IN FOOD SCI. & TECH. 150-54 (1990)
EX1152	<i>Methionine</i> , PUBCHEM, https://pubchem.ncbi.nlm.nih.gov/compound/Methionine
EX1157	U.S. Patent No. 10,039,306 to Vrljic et al.
EX1158	U.S. Patent No. 11,013,250 to Vrljic et al.
EX1159	U.S. Patent No. 11,224,241 to Fraser et al.
EX1160	PCT/US2014/011347
EX1161	U.S. Application No. 13/941,211
EX1162	Redline Comparison between PCT/US2014/011347 and U.S. Application No. 13/941,211
EX1163	PCT/US2014/011361
EX1164	Redline Comparison between PCT/US2014/011361 and U.S. Application No. 13/941,211
EX1165	Certificate of Correction dated May 2018 for U.S. Patent No. 9,943,096
EX1166	85 Fed Reg 12222: Clarification of the Practice for Requiring Additional Information in Petitions Filed in Patent Applications and Patents Based on Unintentional Delay

EX1167	U.S. Provisional Application No. 61/572,205
EX1168	Decision on Patent Owner’s petition under 37 C.F.R. 1.78(c) and (e) for U.S. Application No. 14/797,006
EX1169	Decision on Patent Owner’s petition under 37 C.F.R. 1.78(c) and (e) for U.S. Application No. 15/912,763
EX1170	Decision on Patent Owner’s petition under 37 C.F.R. 1.78(c) and (e) for U.S. Application No. 17/081,922
EX1171	Decision on Patent Owner’s petition under 37 C.F.R. 1.78(c) and (e) for U.S. Application No. 17/531,442
EX1172	Redline Comparison between PCT/US2012/046560 (“Brown”) and U.S. Provisional No. 61/671,069.
EX1173	U.S. Provisional No. 61/572,205
EX1174	Redline Comparison between U.S. Patent No. 9,943,096 and PCT/US2012/046560 (“Brown”)
EX1175	Redline Comparison between U.S. Patent No. 9,943,096 and U.S. Provisional No. 61/671,069
EX1176	Redline Comparison between U.S. Patent No. 9,943,096 and U.S. Provisional No. 61/572,205
EX1177	Redacted Excerpt from Patent Owner Impossible’s Infringement Contentions for U.S. Patent No. 9,943,096 in <i>Impossible Foods Inc. v. Motif Foodworks, Inc.</i> , C.A. No. 22-311 (WCB) (D. Del.)
EX1178	Sarah Cork PHV
EX1179	Derek Huish PHV
EX1180	Wikipedia Article Nutritional Yeast
EX1181	Dr. Robert McGorrin Supplemental Declaration
EX1182	Dr. Qian Deposition Transcript
EX1183	Daniel Tomé – Yeast Extracts: Nutritional and Flavoring Food Ingredients
EX1184	Yasuko Kato – Effect of Some Metals on the Maillard Reaction of Ovalbumin

EX1185	FDA.gov Sodium in Your Diet
EX1186	Jun -- Health Promoting Properties of Natural Flavor Substances
EX1187	Maluly -- Monosodium glutamate as a tool to reduce sodium in foodstuffs: Technological and safety aspects
EX1188	Email showing deposition cancellation of Robert McGorrin

I. INTRODUCTION

Petitioner responds to PO's arguments concerning Grounds 2A-2B and 4A-4C, and relies on the arguments made in the Petition for Grounds 1 and 3A-3D.

For Grounds 2A-2B, Petitioner has shown that a POSITA would have been motivated to combine Giacino and Brown with a reasonable expectation of success in achieving the claimed subject matter of the '096 Patent. PO fails to show otherwise. Instead, PO incorrectly attempts to raise the bar to prove obviousness by characterizing Petitioner's challenge as premised on inherent obviousness. This mischaracterization taints every objection PO raises against Ground 2. However, Petitioner's ground is not based on inherent obviousness.

Rather, Petitioner showed that Giacino discloses meat-flavored compositions that include the claimed sugar and sulfur compounds and produce a meaty aroma (and at least two volatiles having meat-associated aroma) when heated. Indeed, this is undisputed by PO's expert. Petitioner also explained that a POSITA would have had been motivated to add leghemoglobin (an isolated heme-containing protein) to Giacino's compositions, and would reasonably expect success in doing so, because Brown teaches that leghemoglobin contributes favorably to cooked meat aromas. Hence, an absolute guarantee of success is not required under Ground 2.

Accordingly, PO's arguments that Petitioner cannot show that the presence of cysteine, ribose, and thiamine in any composition *inherently* results in the production

of a meaty aroma fails. Similarly, PO's contention that Petitioner did not specify the reaction conditions for PO to "test" whether the Giacino-Brown composition *actually* produces meaty aroma also fails. Only a reasonable expectation of success is required. And, in any event, Petitioner identified specific compositions and reaction conditions in Giacino and Brown.

PO's assertion that Petitioner's expert, Dr. Tarté, lacks the knowledge necessary to testify on whether the proposed combination renders the claims obvious is baseless. Dr. Tarté appropriately relied on Petitioner's flavor chemistry expert, Dr. McGorin, on questions dealing with flavor chemistry that were not the basis of his opinions.

Finally, PO's arguments concerning motivation to combine fail. For example, lipid oxidation is not a concern as Giacino's compositions do not require lipids and Brown teaches that adding leghemoglobin to compositions that contain oil still result in favorable meaty aromas. Any alleged differences in the compositions and underlying reactions driving Giacino and Brown are also inconsequential as PO fails to explain why such differences matter.

As to Grounds 4A-4C, PO's short, dismissive response provides little more than a conclusory assertion that a POSITA would not have added Proulx's soy leghemoglobin to Giacino's compositions to fortify them with heme iron because Giacino's flavor additives were allegedly only meant to provide nutrition. This

ignores authority that a reference itself does not need to suggest the proposed modification and further ignores that common flavor additives are specifically used to provide nutritive benefits to foods.

Petitioner respectfully requests that the challenged claims be found unpatentable.¹

II. GROUNDS 2A-2B: GIACINO, BROWN, MACLEOD RENDER THE CHALLENGED CLAIMS OBVIOUS

A. PO's Arguments Are All Predicated on a Mischaracterization of the Petition and an Erroneous Inherent Obviousness Theory

In an effort to defeat obviousness by artificially raising the bar Petitioner must meet, PO mischaracterizes Grounds 2A-2B as “rest[ing] on an inherent obviousness theory” where “including cysteine, thiamine, and ribose in a composition[] would *necessarily* result in the production of at least two volatile compounds associated with a meaty aroma.” POR, 25.² PO presented the same flawed inherency theory in its POPR (Paper 8, 18-19), which the Board properly rejected. Paper 23 (“I.D.”), 30-32. The Board can safely reject PO’s arguments again because, as explained

¹ The arguments made herein for Grounds 2A and 4A equally apply to Grounds 2B and 4B-4C, respectively, and challenged claims 1-12 and 14-24, unless otherwise stated.

² All emphasis added unless otherwise stated.

further below, Petitioner's ground is based on obviousness, not inherent obviousness. Petitioner need not show that the proposed combination would *necessarily* result in the production of a meaty aroma or at least two volatiles having a meat-associated aroma. Only a reasonable expectation of success is required. *AstraZeneca LP v. Breath Ltd.*, 603 Fed.Appx. 999, 1002 (Fed. Cir. 2015) ("Obviousness requires a showing that a skilled artisan would have perceived a reasonable expectation of success in making the invention.... To meet this standard, only a reasonable expectation of success, ***not a guarantee***, is needed.").

PO's mischaracterization infects every objection PO raises against Grounds 2A-2B. For example, PO contends that the Petition purportedly lacks the requisite degree of particularity to establish obviousness. POR, 25-28. However, this contention hinges on PO's alleged need to "test" "Petitioner's theory of its case[] that including cysteine and ribose in Giacino's composition and further adding leghemoglobin from Brown *will* result in a meaty aroma." POR, 25-28 (emphasis original); Ex. 2030, ¶¶65, 67-69. Similarly, PO argues that Giacino and Brown fail to satisfy limitation 1[e]/10[f] because "Petitioner's conclusion that the claimed volatile compounds would *necessarily* be produced [is] unsupported." POR, 28-30 (emphasis added); Ex. 2030, ¶¶70-71. Finally, in arguing that a POSITA would not have been motivated to combine Giacino and Brown, PO contends that Petitioner's experts and its evidence allegedly fail to show that "the *only possible* outcome" of

adding Brown's leghemoglobin to Giacino's compositions was a positive contribution to meaty aroma. *See* POR, 30-35; Ex. 2030, ¶¶66, 72-80.

Notably, the Petition did not argue that the mere presence of cysteine, ribose, and thiamine in any composition *necessarily* results in a meaty aroma or the production of at least two volatiles having a meat-associated aroma. Nor did Petitioner argue that the combination of Giacino and Brown will *necessarily* produce a meaty aroma or at least two volatiles associated with a meaty aroma.

Rather, the Petition argued that Giacino expressly discloses that its compositions undergo a "reaction" when heated to produce a "*meat[y] flavor*." Paper 7 ("Pet."), 33 (citing Giacino, 2:5-8, 6:15-17, 6:20-23; Ex. 1003, ¶¶208-209); *see also* Giacino, 1:19-25, 1:59-65, 2:48-52 ("the basic reaction mixture is a composition which has a *marked meat flavor*"). A POSITA would understand that Giacino's "meat[y] flavor" refers to a meaty *aroma*. Pet., 33; Ex. 1003, ¶209 (citing Ex. 1005, ¶27 (Dr. McGorin testifying "flavor" and "aroma" are used interchangeably in the art)). PO's expert agrees. Ex. 1182 (Qian Tr.), 40:3-41:22, 48:14-21. PO's expert also agrees that a meaty aroma generally, and Giacino's meaty aroma specifically, implicates the presence of at least two volatiles having a meat-associated aroma. Ex. 1182 (Qian Tr.), 44:5-23, 47:4-49:14 (Dr. Qian admitting that Giacino's meaty aroma means more than two volatiles having a meat-associated aroma are present); Ex. 2032, 63:11-64:22 (Dr. Tarté testifying that

“heating [Giacino’s] composition...would generate volatiles[,] [w]hich are responsible for the [meaty] flavor”); Ex. 1181 (McGorin Suppl.), ¶¶12-15. The Board similarly recognized that “Giacino’s heating produces volatiles that produce the claimed ‘aroma,’” and that PO’s arguments could not explain “how the volatiles produced by Giacino’s heating, which Giacino discloses produces the desired meaty ‘flavor,’ would not also produce the required ‘aroma.’” I.D., 31-32.

In connection with Giacino’s teachings, Petitioner further explained that it “is not surprising” that Giacino’s compositions have a meaty aroma given that several of the compounds in Giacino’s compositions—*e.g.*, ribose, cysteine, thiamine, protein hydrolysate—are well-known flavor precursors that have been used in “reaction product”-based meat flavoring compositions for decades and are known to produce scores of volatile compounds having a meat-associated aroma. Pet., 34 (citing Ex. 1003, ¶¶210-211); Ex. 1005, ¶¶45-55, 67-70, 75-78. Thus, contrary to PO’s mischaracterization, the Petition did not allege that the mere presence of cysteine, ribose, and thiamine in any composition—***divorced from Giacino’s teachings and compositions***—would always result in the production of at least two volatiles having a meat-associated aroma no matter the environmental conditions/factors. Instead, use of these well-known flavor precursors in Giacino’s compositions coupled with Giacino’s express disclosure that its compositions *produce a meat flavor/aroma when heated*, demonstrate to a POSITA that Giacino’s

compositions produce at least two volatiles having a meat-associated aroma. Pet., 33-34; Ex. 1003, ¶¶209-211; Ex. 1182 (Qian Tr.), 47:4-49:14; Ex. 2032, 63:11-64:22; Ex. 1181, ¶¶16-20.

As to Brown's teachings, Petitioner showed that Brown teaches adding leghemoglobin would further contribute to Giacino's meaty aroma. Pet., 34; Ex. 1003, ¶212. A POSITA would have been motivated to add Brown's leghemoglobin to Giacino's compositions to provide a cooked meat aroma/flavor that would further Giacino's goal of producing a "true[r] flavor" of meat. Pet., 29-30; Ex. 1003, ¶¶174-175, 193-194. To that end, Brown disclosed that specific volatile compounds (*e.g.*, 2-octanone, 2-methylfuran, "and many other unidentified compounds") were produced exclusively or more abundantly in compositions containing leghemoglobin versus those without. *Id.* Petitioner explained that a POSITA would have had a reasonable expectation of success based on, *inter alia*, the similarities between Brown's and Giacino's compositions. Pet., 30-31; Ex. 1003, ¶¶174, 184, 193, 196; Ex. 2032, 77:6-78:9. Hence, Petitioner's theory is not that the combination of Giacino and Brown will *necessarily* produce a meaty aroma or produce at least two meat-associated volatiles, as PO alleges, but instead that a POSITA would have been motivated to add Brown's leghemoglobin to Giacino's compositions and would have had a reasonable expectation of success in achieving a meaty aroma or at least two volatiles having a meat-associated aroma.

Accordingly, each of PO's objections to Grounds 2A-2B fail because they are predicated on the above mischaracterizations and an erroneous belief that Petitioner's burden is to show that the proposed combination *necessarily* produces a meaty aroma or at least two volatiles having a meat-associated aroma.

B. The Reaction Factors/Conditions PO Identifies Are Therefore Irrelevant

PO identifies, *inter alia*, pH, cooking time, cooking temperature, moisture, particle size, compositional structure/milieu, etc. as factors/conditions that may play a role in the reactions driving aroma and volatile compound production. POR, 25-27 (citing Ex. 2030, ¶¶35-40, 65, 67-68; Ex. 1005, ¶¶56, 98-99, 103-104, 106, 150-151, 158-159, 162, 164); POR, 29. PO argues that because these factors/conditions might impact a composition's aroma/volatile profile, Petitioner cannot show that the mere presence of cysteine, ribose, and thiamine in any composition *necessarily* results in the production of a meaty aroma or two volatiles having a meat-associated aroma. *See* POR, 25-30; Ex. 2030, ¶¶67-71. However, since Petitioner did not make this argument (*supra* Section II.A), PO's contention is irrelevant and fails.

Moreover, a POSITA would also understand that Giacino accounts for the various factors/conditions identified by Petitioner (Ex. 2030, ¶¶35-40, 68-71) because Giacino expressly teaches that its compositions produce a meaty flavor/aroma after undergoing a "reaction" when heated. Giacino, 6:15-23. Ex. 1181, ¶¶21-22. Additionally, the above factors/conditions were well-known to a

POSITA and only ordinary skill would have been needed to follow the teachings of the prior art and adjust these conditions/factors to produce a meaty aroma and volatiles. *Id.*, ¶¶23-27. Relatedly, PO's assertion that Giacino does not expressly disclose the Maillard reaction is inapposite because the claims do not require any particular reaction and Giacino's disclosures related to precursors, "reactions," cooking times/temperatures, all support a finding that Giacino's compositions do undergo a Maillard reaction. *Id.*, ¶¶28-30.

PO similarly argues that the presence of other ingredients besides cysteine, thiamine, and ribose in the composition, such as taurine or leghemoglobin, would also impact the reactions driving aroma and volatile compound production and, therefore, Petitioner cannot conclude that limitations 1[e]/10[f] are "necessarily" satisfied. Ex. 2030, ¶¶70-71; POR, 29-30. Again, PO's contention fails because Petitioner did not make this argument. *Supra*, Section II.A.

Moreover, the claims do not exclude taurine and Giacino's compositions produce meaty aromas and volatiles having a meat-associated aroma despite containing taurine. Ex. 1181, ¶¶31-35. As to adding leghemoglobin, PO ignores Giacino's and Brown's teachings that preparing their meat-flavored compositions results in the production of volatiles having a meat-associated aroma. *Id.*, ¶¶36-42. Moreover, a POSITA would have the relevant skill and training to make any adjustments, if needed, to the preparation of Giacino's compositions when adding

Brown's leghemoglobin to achieve the meaty aromas and volatiles taught therein. *Id.*, ¶¶43-46, 51-53.

C. The Petition Does Not Lack Particularity to Show Obviousness

PO's argument that the Petition lacks the requisite degree of particularity to establish obviousness is wrong. First, PO's contention fails because it is predicated on PO's mischaracterization of the Petition and Petitioner's burden of proof. *Supra*, Section II.A.

Second, Petitioner satisfied its burden of particularity by identifying specific compositions described in Giacino and Brown as the basis for its obviousness combination. For example, Petitioner expressly identified and analyzed a specific composition containing thiamine, taurine, cysteine, hydrolyzed vegetable protein, ribose, and leghemoglobin. Pet., 32-33; *see id.*, 31-33 (citing Giacino, 2:5-8, 2:53-60, 3:23-25, 3:43-46, 5:1-10, 6:1-7). Petitioner also cited detailed information concerning precursor concentration ranges and heating instructions. *See, e.g.*, Pet., 31-33, 38-39 (citing Giacino, 5:1-10, 6:26-31, 6:68-71). PO's expert undermines PO's contention as he suggested that the above information, including precursor concentrations, ratio ranges, and heating instructions provided sufficient detail to allow a POSITA to recreate a meat flavored substitute known to have a meaty aroma. *See* Ex. 1182 (Qian Tr.), 36:18-37:2, 38:15-23.

Third, the challenged claims do not require the level of specificity PO demands. Claim 1 broadly claims a composition comprising a heme protein, sugar, and sulfur compound. The composition contains no animal products and produces at least two volatile compounds when cooked. Notably, claim 1 places no restrictions on the specific combination of sugars/sulfurs listed, their amount/concentration, cooking temperature/time, pH, moisture, or any of the other factors/conditions PO states are purportedly necessary for Petitioner to establish obviousness. POR, 25-28. Accordingly, PO's assertion that Petitioner allegedly does not identify the specific amounts of each flavor precursor and all of the environmental conditions that give rise to the Maillard reaction to produce the meat-associated volatiles is baseless because the claim itself includes no such restrictions.

D. Dr. Tarté's Testimony Support's Petitioner's Obviousness Ground

PO's accusation that Dr. Tarté lacks the knowledge necessary to testify on whether the proposed combination renders limitation 1[e]/10[f] obvious is baseless. POR, 28-29, 31-32. PO's contention is based on Dr. Tarté's appropriate reliance on Petitioner's flavor chemistry expert, Dr. McGorin, on the questions of whether "nothing else matter[ed]" other than the presence of cysteine and ribose in a composition to generate a meaty aroma and whether "the only possible outcome" of adding leghemoglobin to Giacino's composition was a positive contribution to

meaty aroma. POR, 28-29 (citing Ex. 2032, 57:7-58:24), 31-32 (citing Ex. 2032, 78:10-25).

First, Dr. Tarté's reliance on Dr. McGorin for these questions does nothing to discredit his opinions as to the obviousness of the challenged claims in view of Giacino and Brown because Dr. Tarté did not opine that the presence of cysteine and ribose in any composition *necessarily* results in a meaty aroma. Nor did Dr. Tarté opine that the only possible outcome of adding leghemoglobin to Giacino's composition was a positive contribution to meaty aroma. Instead, Dr. Tarté's basis for why limitation 1[e]/10[f] is obvious was premised on Giacino's disclosure that its compositions, which include well-known meat flavor precursors, produce a meaty aroma when heated, and that a POSITA would have been motivated to add Brown's leghemoglobin to Giacino's compositions with a reasonable expectation of success. *See supra*, Section II.A; *see also* Ex. 1003, ¶¶170-213.³ Accordingly, when

³ PO misconstrues the figure of speech—"would only further"—to mean "the only possible result." POR, 31-32 (citing Ex. 1003, ¶212). This is not what those words intended and that is clear given Petitioner's and Dr. Tarté's extensive and repeated arguments that a POSITA would have had a *reasonable expectation* of success (not absolute certainty) in achieving the cooked meat aroma touted by Brown when

confronted with these questions, Dr. Tarté appropriately deferred to the expertise of Petitioner's flavor chemistry expert, Dr. McGorin.

Tellingly, PO had the opportunity to cross-examine Dr. McGorin on these questions, yet decided not to, *canceled* Dr. McGorin's deposition about *17 hours* before it was to commence and *after* PO had taken Dr. Tarté's deposition and knew Dr. Tarté relied on Dr. McGorin's knowledge to answer these questions. Ex. 2032, 119 (Tarté's deposition concluding at 1:37 pm PT on Sept. 7, 2023); Paper 31 (noticing McGorin's deposition for Sept. 8, 2023); Ex. 1188, 1 (cancelling McGorin's deposition at 3:28 pm PT on Sept. 7, 2023). If PO believed the answers it sought were somehow relevant to its defense (they were not), PO could have and should have cross-examined Dr. McGorin. PO cannot now cry foul after intentionally passing on the deposition of the expert addressing such questions. PO's gamesmanship and willful blindness to a POSITA's true knowledge should not be rewarded.

Indeed, contrary to PO's accusations, Dr. Tarté provided a reasoned opinion, based in part on Dr. McGorin's testimony concerning flavor chemistry, that a POSITA would have been motivated to combine Giacino and Brown and would have

adding Brown's leghemoglobin to Giacino's compositions. Pet., 30-31; Ex. 1003, ¶¶184-185, 196.

had a reasonable expectation of success in achieving the claimed invention. *See* Ex. 1003, ¶¶170-213 (citing Ex. 1005, Sections V.B, V.D).

E. PO's Expert Concedes That Giacino Discloses Volatiles Having a Meat-associated Aroma

PO's contention that the proposed combination fails to satisfy limitation 1[e]/10[f] is undermined by its own expert's, Dr. Qian, admission that Giacino's compositions produce, when heated, a meaty aroma and at least two volatiles associated with a meat aroma:

Q. When Giacino says "a meaty flavor is developed," what does that mean to you?

A. My understanding would be some *aroma* [is] generated which [is] associated with – give[s] a *meaty* attribute.

Q. And that aroma comprises volatile compounds, right?

A. Yes.

Q. Certainly more than two?

A. *Very likely*.

Q. Is there anything about Giacino's teaching here that...leads you to believe that less than ten volatiles are being generated?

A. I do not believe so.

Q. You do not believe so?

A. *I believe it will be more compounds generated.*

Q. *Than ten?*

A. *Right.*

Ex. 1182 (Qian Tr.), 47:4-49:14; *see also id.*, 44:5-44:23.

Thus, it is undisputed that Giacino's contribution to the proposed combination satisfies limitations 1[e]/10[f]. The question before the Board is whether a POSITA would have been motivated to add Brown's leghemoglobin to Giacino's compositions and whether a POSITA would have had a reasonable expectation of success in at least maintaining the baseline meaty aroma/volatiles Giacino provides. The institution decision found that the Petition made this showing. I.D., 24-32. As explained below, the Board can reject PO's failed rebuttal arguments and affirm its earlier findings.

F. PO Fails to Rebut Petitioner's Motivation to Combine and Reasonable Expectation of Success

Petitioner established both a motivation to combine Giacino and Brown and a reasonable expectation of success in achieving the claimed invention. Pet., 28-31; Ex. 1003, ¶¶170-176, 183-185, 190-196. PO's objections to the proposed combination are predicated on unsupported assertions that trivial differences between Giacino's and Brown's compositions may introduce some uncertainty as to the actual effect leghemoglobin has on Giacino's compositions' aroma. POR, 32-35; Ex. 2030, ¶¶72-80. However, "obviousness cannot be avoided simply

by...showing...some degree of unpredictability in the art.” *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1364 (Fed. Cir. 2007). “Indeed, a rule of law equating unpredictability to patentability...would mean that any new [heme-containing composition]...would be separately patentable, simply because the formation and properties of each [composition] must be verified through testing. This cannot be the proper standard since the expectation of success need only be reasonable, not absolute.” *Id.* As explained below, each of PO’s arguments against motivation to combine fail.

1. *Dr. McGorrin’s Unrelated “Plant Protein” Testimony Is Irrelevant*

PO argues that Dr. McGorrin’s testimony in this proceeding and before the district court concerning “plant proteins” undermines Petitioner’s motivation to combine. POR, 32-33. Not so. PO’s argument hinges on unsupported attorney-argument and should be given less weight. Moreover, the testimony PO cites to relates to disclosures made in PO’s own patents, not how a POSITA would view the prior art or how that understanding relates to the obviousness of the claims here. Ex. 1181, ¶¶55-56. Additionally, Brown teaches that its compositions, which *do* include plant proteins (*e.g.*, in pea flour), benefit from the addition of leghemoglobin by exhibiting improved cooked meat aroma profiles. *Id.*, ¶¶57-59.

2. PO's Lipid Oxidation Arguments Fail

As an initial matter, PO's arguments concerning lipid oxidation should not be considered under 37 C.F.R. §42.6(a)(3) because PO improperly incorporates by reference roughly *4.5 pages* of argument and evidence from its expert's declaration through a *single* sentence in the POR. POR, 33 (citing Ex. 2030, ¶¶38-40, 75-80).

Even if considered, PO's contentions fail. First, lipid oxidation is a non-issue for claims 1-7, 9-12, 14-16, 18-20, and 22-24 because Giacino's compositions do not require lipids.⁴ Ex. 1181, ¶¶60-68; Ex. 1182 (Quan Tr.), 87:19-92:5 (PO's expert agreeing lipids are necessary for lipid oxidation). Moreover, Brown teaches that adding leghemoglobin to compositions containing oil contributes favorably to cooked meat aromas. Brown, [0364], [0412]. Ex. 1181, ¶69. And, as PO's and Petitioner's experts explained, lipid oxidation can actually contribute positively to meat flavor. Ex. 1181, ¶¶69-70; Ex. 1182, 82:20-83:4; Ex. 1005, ¶¶130-136.

PO's assertions concerning "shelf life" are also incorrect because Giacino teaches that its compositions can be added to foods *first* and then cooked. Giacino, 6:71-7:2; Ex. 1181, ¶¶71-74. Relatedly, the claims do not place restrictions on shelf life. *Id.*, ¶¶75-80.

⁴ Petitioner's analysis for claims 8, 17, and 21, however, are based on Giacino's oil-containing compositions.

3. *Any Differences in Reaction Pathways Between Giacino and Brown Do Not Undermine Motivation to Combine*

PO's contention that a POSITA would not have been motivated to combine Giacino and Brown because "Giacino identifies taurine and thiamine as the basis for its meaty flavor, while Brown attributes leghemoglobin to its meaty aroma" is meritless. POR, 33. First, Giacino teaches that meaty aroma is produced by heating its compositions, which contain various ingredients besides taurine and thiamine. Giacino, 6:5-7, 6:1-14; Ex. 1181, ¶¶86-88. Brown also does not teach that its meaty flavor is based solely on leghemoglobin; indeed, its compositions include the known Maillard precursor glucose. *Id.*, ¶89; Brown, [00364].

Second, PO mischaracterizes Petitioner's argument as requiring *identical* reaction chemistry. Rather, Petitioner asserts that a POSITA would be motivated to combine Giacino's compositions with Brown's leghemoglobin in order to improve or enhance meaty aroma. Pet., 28-31; Ex. 1181, ¶¶90-92. Notwithstanding, both Giacino and Brown teach similar reaction chemistry as both implicate Maillard. *Id.*, ¶¶93, 96-97. Moreover, Brown teaches the significance of iron-containing heme, highlighting the potential importance of that chemical structure in creating "enhanced" meaty aromas. *Id.*, ¶¶94-95.

Additionally, PO presents no argument/evidence explaining why the reactions driving Giacino's meaty aroma cannot occur in the same composition with the leghemoglobin-based reaction driving Brown's meaty aroma (even assuming

different chemical reactions are involved). *See* Ex. 2030, ¶73. Indeed, a POSITA knows that different reactions producing meaty aromas, such as Strecker and Maillard, can occur at the same time in the same composition when heated. Ex. 1181, ¶¶98-99; Ex. 1182 (Qian Tr.), 49:8-51:23 (Dr. Qian concluding same).

4. *Any Differences in Structure Between Giacino and Brown Do Not Undermine Motivation to Combine*

PO further argues that Giacino's and Brown's compositions are "completely different" because Giacino's compositions are purportedly "concentrated," while Brown's compositions are not. Ex. 2030, ¶74. PO contends that "Petitioner has not explained why a POSA...would have *combined a meat replica with the concentrated flavoring composition of Giacino.*" *Id.*, ¶¶74-75; POR, 33. PO's conclusory contention fails for multiple reasons.

First, the Board already rejected this argument because "the Petition proposes to modify Giacino with the addition of Brown's leghemoglobin as a flavoring agent, not as a structural component of Brown's meat replica." I.D., 28 (citing Pet., 30).

Also, PO's naked assertion that there exists some uncertainty as to whether Brown's leghemoglobin will actually contribute meaty aromas/volatiles to Giacino's composition because Giacino's composition is different than Brown's does not negate a motivation to combine/reasonable expectation of success. *Pfizer*, 480 F.3d at 1364 ("obviousness cannot be avoided simply by...showing...some degree of unpredictability in the art").

Moreover, PO unduly limits a POSITA's willingness to apply teachings in one context (Brown's muscle replica) to a slightly different context (Giacino's meaty-flavored compositions) without explanation. Brown does not disclose or suggest that adding leghemoglobin contributes positively to meaty aroma only in the context of muscle replicas. Nor does Dr. Qian provide any evidence to suggest otherwise. And while these two compositions may not be identical, they undeniably have similarities, including that they include sugars and proteins/amino acids and are used in meat substitutes. Ex. 1181, ¶¶40-41, 81-85. Additionally, only ordinary skill would have been required to make adjustments to the concentration of leghemoglobin added to Giacino's compositions. *Id.*, ¶50.

5. *PO Does Not Rebut Petitioner's Reasonable Expectation of Success*

Petitioner explained that a POSITA would have had a reasonable expectation of success in achieving the claimed invention because nothing more than ordinary skill would have been required to obtain Brown's leghemoglobin and mix it into Giacino's composition prior to heating. Pet., 31; Ex. 1003, ¶¶184, 196. Moreover, Brown's and Giacino's compositions are both consumable products and have similar ingredients including reducing sugars and plant proteins/amino acids. Pet., 28-34; Ex. 1003, ¶¶196, 201-202, 210 (Giacino includes thiamine, taurine, vegetable protein hydrolysate, cysteine, ribose), 174, 193 (Brown includes plant protein (pea

flour), glucose, oil). The Petition argued that these similarities support a reasonable expectation of success. Pet., 30-31; Ex. 1003, ¶¶184, 196.

The POR did not dispute the assertions above. See POR, 30-35. PO only argued that pea flour proteins are not the claimed flavor precursors. POR, 34.⁵ But both compositions still have sugars and proteins or partial proteins. As the Petition explained, Giacino’s compositions include vegetable protein hydrolysate (Pet., 32-33), which Giacino teaches “need not be completely hydrolyzed” and instead may have “various stages of peptide degradation” (Giacino, 3:14-17); Ex. 1181, ¶¶40-41.

6. *PO’s Arguments Fail to Consider That Claims 1-9, 24 Do Not Require Any Particular Aroma*

PO’s arguments oppose the proposed combination because there is allegedly some unpredictability as to whether Brown’s leghemoglobin will have the “same effect” in Giacino’s compositions—*i.e.*, “contribute *favorably* to aroma” (Brown, [0364])—or will otherwise provide an “undesirable” or “warmed-over-flavor.” Ex. 2030, ¶70 (leghemoglobin may “shift [aroma] from desirable to undesirable”), 74

⁵ PO’s expert is silent on this issue. Hence, it is unclear what, if any, significance this assertion has on a POSITA’s motivations and expectations concerning the proposed combination.

(no expectation of “same effect” of Brown in Giacino where reactions may be different), 75-80 (discussing risk of warmed-over-flavor).

These arguments fail to consider that claims 1-9 and 24 do not require any particular aroma, whether meat-like or even desirable, to be produced when the claimed composition is cooked. Instead, all that is required is the production of at least two volatiles having a meat-associated aroma. Hence, it is irrelevant to these claims whether, if in adding leghemoglobin and cooking the composition, the resulting aroma is (to the surprise of a motivated POSITA) less favorable, is undesirable, or has a warmed-over-flavor, so long as at least two volatiles having a meat-associated aroma are present.

As Dr. McGorin explains, even if adding leghemoglobin had an unfavorable impact on aroma, a POSITA would reasonably expect that at least two or more volatiles having a meat-associated aroma produced by Giacino would still remain, thereby satisfying limitation 1[e]. Ex. 1181, ¶¶47-50.

III. GROUNDS 4A-4C: GIACINO, PROULX, PERRET, MACLEOD RENDER THE CLAIMS OBVIOUS

Grounds 4A-4C modify Giacino’s compositions to include Proulx’s leghemoglobin. Pet., 58-61. The Petition argued a POSITA would have been motivated to add Proulx’s leghemoglobin for two separate, distinct reasons: iron fortification/nutritive benefits touted by Proulx; and improved meat flavor disclosed by Conrad. *Id.* Each motivation is independent from the other:

Accordingly, whether to fortify the composition with heme iron *and/or* to enhance meat flavor, a POSITA would have been motivated to add soy leghemoglobin to Giacino's compositions.

Pet., 61 (emphasis original); Ex. 1003, ¶397 (same).

Hence, a POSITA would have been motivated to include soy leghemoglobin in Giacino's compositions for the *additional (and separate)* reason of improving their flavor profile.

Pet., 61 (emphasis added).

Thus, Petitioner can prevail based on Proulx's fortification motivation alone.

Conrad is unnecessary to the ground.

A. PO Did Not Dispute Key Facts

The POR did not dispute that:

- Giacino's composition lacks a significant source of iron (Ex. 1003, ¶391);
- Proulx's leghemoglobin is an isolated heme-containing protein that provides heme iron having high bioavailability and heat stability (Pet., 59-60);
- Only ordinary skill would have been needed to isolate and add leghemoglobin to Giacino's composition (Pet., 61);
- Adding leghemoglobin to Giacino's composition would in fact fortify it with heme iron (Pet., 58-61);

- Adding Giacino’s modified, leghemoglobin-containing composition to foods, including meat substitutes, would fortify those foods with heme iron, which would encourage consumption by consumers (Ex. 1003, ¶393).

See POR, 50-51.

B. PO’s Objections Fail

PO’s three objections to Proulx fail. First, PO’s contention that “Conrad already includes hemoglobin and Petitioner does not explain why a POSA, *already seeking to add Conrad’s blood...*, would *seek to further replace that blood* for ‘improved bioavailability of heme iron’” (POR, 51) is based on PO’s misunderstanding that Ground 4A allegedly “swaps out Crane for Proulx and asserts the *same rationale...*in Ground 3A.” Ex. 2030, ¶100; POR, 50. But, unlike Ground 3A, Grounds 4A-4C are not predicated on adding Conrad’s hemoglobin to Giacino’s composition and then replacing that hemoglobin with another similar compound. Instead, Grounds 4A-4C add Proulx’s isolated leghemoglobin to Giacino’s compositions in the *first instance* to fortify Giacino’s compositions with heme iron. Pet., 58-60; Ex. 1003, ¶¶390-394, 402, 407-412.

Second, PO argues that Giacino does not suggest that its flavor additives are meant to provide nutritional content to foods, and Petitioner’s attempt to improve the nutritional content of a “flavor” additive is allegedly “baseless.” POR, 50-51 (citing Ex. 2030, ¶101). PO’s arguments are both legally and factually flawed.

“[A]n obviousness determination does not require prior art to expressly state a motivation for every obvious combination.” *Intel Corp. v. Qualcomm Inc.*, 2022 WL 880681, at *3 (Fed. Cir. 2022). And certainly, “there is no requirement that a motivation to combine must be separately expressed in *each* prior art reference.” *Id.* (emphasis original); *see also Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1381 (Fed. Cir. 2023) (a motivation to combine may be found “*even absent any hint of suggestion* in the references themselves”) (emphasis original).

Here, it is irrelevant whether Giacino suggests Petitioner’s iron fortification motivation because *Proulx* does. *Proulx* describes methods for isolating leghemoglobin and supplementing foods with leghemoglobin to fortify them with heme iron, which has high bioavailability. Pet., 58-59; Ex. 1003, ¶408. This helps address “a major nutritional problem,” iron deficiency, “affecting over 2 billion people.” *Proulx*, 1518. Giacino’s compositions do not contain significant sources of iron, especially heme iron, and thus would benefit from *Proulx*’s teachings. Pet. 58-59; Ex. 1003, ¶407. Accordingly, a POSITA would have been motivated to add *Proulx*’s leghemoglobin to Giacino’s compositions to fortify them with heme iron, which would encourage consumers to eat foods, such as meat substitutes, made with Giacino’s fortified compositions. Pet., 59; Ex. 1003, ¶¶410-411; *see also Giacino*, 7:18-26 (flavoring compositions added to “synthetic meat fibres”).

Moreover, “[I]f...a [POSITA] would recognize that [a technique] would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Here, Proulx teaches a known technique for fortifying consumable products with heme iron, and the POR did not dispute that the technique could be used to fortify Giacino’s compositions in the same way to achieve a similar result. *See* POR, 50-51; Pet., 61.

PO’s contention “that flavor additives are meant to impart flavor, rather than nutrition” is also factually inaccurate and unsupported. Ex. 2030, ¶101. The lone publication (“Manley”) PO’s expert relies on does not support his position. Indeed, Manley suggests the opposite—that food flavor additives *can* provide nutritional benefits, even going so far as describing the process/forms used to notify the USDA that a proposed flavoring additive “make[s] a significant nutritional contribution to the final food.” Ex. 1038, 149-150; Ex. 1181, ¶¶100-102.

Also, it is well-known that many common flavoring additives are utilized specifically for their nutritive benefits, including, for example, nutritional yeast, garlic, salt, and MSG. Ex. 1181, ¶¶103-109; Ex. 1182 (Qian Tr.), 101:12-102:2, 102:21-103:6. Thus, there is nothing unusual about having a flavor additive, like Giacino’s, provide a nutritional benefit.

Further undermining PO's position is that PO boasted to the FDA the "nutritive value" its heme-containing *flavor* additive provided. Pet., 60; Ex. 1003, ¶394. Remarkably, PO cited to *Proulx* in support of its claims. *Id.* That PO openly advertises that its flavor additives, whose "primary purpose...is to create a flavor impact," also provide nutritional benefits makes its current position that flavor additives categorically cannot be used to provide nutrition indefensible.

Third, PO questions whether Proulx's leghemoglobin "would result in a flavor composition having acceptable organoleptic properties" due to potential lipid oxidation. POR, 51 (citing Ex. 2030, ¶¶38-40, 75-80).⁶ Potential lipid oxidation would not discourage a POSITA from modifying Giacino to include leghemoglobin because: Giacino's compositions do not require lipids (hence no lipid oxidation); lipid oxidation was known to provide beneficial flavor and takes time to develop; and intact heme-proteins, like leghemoglobin, were not known to cause off-flavors. Ex. 1181, ¶¶110-111. Hence, a POSITA would reasonably expect that lipid oxidation would not negatively impact Giacino's meaty aroma.

⁶ PO's incorporation by reference of 4.5 pages of argument/evidence from its expert's declaration is improper.

PO's remaining objections to Grounds 4A-4C are directed at Conrad, which is not necessary for the ground (except dependent claim 14). POR, 51 (citing Ex. 2030, ¶¶84-94, 102).

IV. CONCLUSION

Petitioner respectfully requests that the challenged claims be found unpatentable.

Date: January 5, 2024

By: /s/ Joseph Paunovich
Joseph Paunovich (Reg. No. 59,044)
QUINN EMANUEL URQUHART &
SULLIVAN LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, CA 90017
qeimpossibleipr@quinnemanuel.com
Phone: 213-443-3000
Fax: 213-443-3100

Lead Attorney for Petitioner
Motif Foodworks, Inc.

CERTIFICATE OF COMPLIANCE

I hereby certify that this paper complies with the type-volume limitation of 37 C.F.R. § 42.24 because it contains 5,584 words, excluding the parts of the paper exempted by 37 C.F.R. § 42.24(b).

Date: January 5, 2024

By: /s/ Joseph Paunovich

Joseph Paunovich (Reg. No. 59,044)
QUINN EMANUEL URQUHART &
SULLIVAN LLP

865 S. Figueroa Street, 10th Floor
Los Angeles, CA 90017

qeimpossibleipr@quinnemanuel.com

Phone: 213-443-3000

Fax: 213-443-3100

*Lead Attorney for Petitioner
Motif Foodworks, Inc.*

CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing Petitioner's Reply to Patent Owner's Response, and associated exhibits, were served in their entirety on January 5, 2024 via Electronic Mail directed to counsel of record for the Patent Owner at the following:

Lead Counsel	Back-Up Counsel
Michael T. Rosato USPTO Reg. No. 52,182 WILSON SONSINI GOODRICH & ROSATI 701 Fifth Avenue, Suite 5100 Seattle, WA 98104 Tel.: 206-883-2529 Fax: 206-883-2699 Email: mrosato@wsgr.com	Lorelei P. Westin USPTO Reg. No. 52,353 WILSON SONSINI GOODRICH & ROSATI 12235 El Camino Real, Suite 200 San Diego, CA 92130 Tel.: 858-350-2225 Fax: 858-350-2399 Email: lwestin@wsgr.com Wendy L. Devine USPTO Reg. No. 61,309 WILSON SONSINI GOODRICH & ROSATI One Market Plaza, Spear Street Tower, Suite 3300 San Francisco, CA 94105 Tel.: 415-947-2027 Fax: 415-947-2099 Email: wdevine@wsgr.com Matthew R. Reed USPTO Reg. No. 48,879 WILSON SONSINI GOODRICH & ROSATI 650 Page Mill Road Palo Alto, CA 94304 Tel.: 650-565-3990 Fax: 650-493-6811 Email: mreed@wsgr.com

Lead Counsel	Back-Up Counsel
	Tasha M. Thomas USPTO Reg. No. 73,207 WILSON SONSINI GOODRICH & ROSATI 1700 K Street, NW, Fifth Floor Washington, DC, 20006 Tel.: 202-973-8883 Fax: 202-973-8899 Email: tthomas@wsgr.com

Date: January 5, 2024

By: /s/ Razmig Messerian
Razmig Messerian (Reg. No. 56,983)
QUINN EMANUEL URQUHART &
SULLIVAN LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, CA 90017
qeimpossibleipr@quinnemanuel.com
Phone: 213-443-3000
Fax: 213-443-3100

Counsel for Petitioner
Motif Foodworks, Inc.