

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RIMFROST AS,
Petitioner,

v.

AKER BIOMARINE ANTARCTIC AS,
Patent Owner.

Case IPR2017-00746
Patent 9,028,877 B2

Before ERICA A. FRANKLIN, TINA E. HULSE, and
JACQUELINE T. HARLOW, *Administrative Patent Judges*.

HARLOW, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Determining That Claims 1–19 Have Been Shown to Be Unpatentable
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Rimfrost AS (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–19 of U.S. Patent No. 9,028,877 B2 (Ex. 1001, “the ’877 patent”). Paper 2 (“Pet.”). Aker Biomarine Antarctic AS (“Patent Owner”) declined to file a Preliminary Response.

On August 16, 2017, we instituted an *inter partes* review of all challenged claims on all grounds asserted. Paper 8. On November 8, 2017, Patent Owner filed a Patent Owner Response to the Petition. Paper 13 (“PO Resp.”). On January 24, 2018, Petitioner filed a Reply to the Patent Owner Response. Paper 16 (“Reply”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. Having considered the record before us, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–19 of the ’877 patent are unpatentable. *See* 35 U.S.C. § 316(e).

A. Related Matters

The ’877 patent is asserted in *Aker Biomarine Antarctic AS v. Olympic Holding AS*, Case No. 1:16-CV-00035-LPS-CJB (D. Del.). Pet. 2; Paper 7, 2–3. In addition, Petitioner has challenged, and we have instituted *inter partes* review of, the claims of the ’877 patent in IPR2017-00748. Paper 5, 2.

Petitioner also challenges U.S. Patent No. 9,078,905 B2 (“the ’905 patent”) in IPR2017-00745 and IPR2017-00747. Pet. 3. Both the ’877 patent and the ’905 patent are continuations of U.S. Patent Application No. 12/057,775, filed March 28, 2008.

The parties have not identified any further, currently pending, related proceedings concerning the '877 patent.¹

B. The '877 Patent

The '877 patent, titled “Bioeffective Krill Oil Compositions,” issued May 12, 2015, with Inge Bruheim, Snorre Tilseth, and Daniele Mancinelli as the listed co-inventors. Ex. 1001, [54], [45], [72].

The '877 patent describes extracts from Antarctic krill, small shrimp-like animals, that include bioactive fatty acids. Ex. 1001, 1:19–20. In particular, the '877 patent discloses krill oil compositions having “high levels of astaxanthin, phospholipids, includ[ing] enriched quantities of ether phospholipids, and omega-3 fatty acids.” *Id.* at 9:28–31.

The '877 patent states that myriad health benefits have been attributed to krill oil in the prior art. For example, the '877 patent states that “[k]rill oil compositions have been described as being effective for decreasing cholesterol, inhibiting platelet adhesion, inhibiting artery plaque formation, preventing hypertension, controlling arthritis symptoms, preventing skin cancer, enhancing transdermal transport, reducing the symptoms of premenstrual symptoms or controlling blood glucose levels in a patient.” Ex. 1001, 1:46–52. In addition, the '877 patent recognizes that krill oil compositions, including compositions having up to 60% w/w phospholipid

¹ The '877 patent was also asserted in *In the Matter of Certain Krill Oil Products and Krill Meal for Production of Krill Oil Products*, Investigation No. 337-TA-1019 (USITC) (Pet. 2–3; Paper 3, 1); however, Petitioner states that the investigation has been “effectively terminated.” Paper 21, 3.

content and as much as 35% w/w EPA/DHA content, were known in the art prior to the time of invention. *Id.* at 1:52–57. The '877 patent also indicates that supercritical fluid extraction with solvent modifier was known to be a useful method for extracting marine phospholipids from salmon roe. *Id.* at 1:65–67.

According to the '877 patent, however, the solvent extraction methods used in the prior art to isolate krill oil from the krill “rely on the processing of frozen krill that are transported from the Southern Ocean to the processing site,” which transportation is expensive and may result in the degradation of the krill starting material. *Id.* at 2:3–6. Such methods have included steps of placing the material into a ketone solvent, such as acetone, to extract the lipid soluble fraction, and recovering the soluble lipid fraction from the solid contents using a solvent such as ethanol. *Id.* at 1:32–40.

To overcome the above limitations, the '877 patent discloses “methods for processing freshly caught krill at the site of capture and preferably on board a ship.” *Id.* at 10:18–20. The '877 patent explains that the krill may be first subject to a protein denaturation step, such as a heating step, to avoid the formation of enzymatically decomposed oil constituents. *Id.* at 9:43–50; 10:26–31. Subsequently, the “oil can be extracted by an optional selection of nonpolar and polar solvents including use of supercritical carbon dioxide.” *Id.* at 9:51–54.

In Example 7 of the '877 patent, “[k]rill lipids were extracted from krill meal (a food grade powder) using supercritical fluid extraction with co-solvent.” *Id.* at 31:15–16.

Initially, 300 bar pressure, 333°K and 5% ethanol (ethanol:CO₂, w/w) were utilized for 60 minutes in order to remove neutral lipids and astaxanthin from the krill meal. Next, the ethanol content was increased to 23% and the extraction was maintained for 3 hours and 40 minutes. The extract was then evaporated using a falling film evaporator and the resulting krill oil was finally filtered.

Id. at 31:17–23.

Example 8 of the '877 patent prepared krill oil using the same method described in Example 7, from the same krill meal used in that example.

Ex. 1001, 31:46–47. The krill oil was then analyzed using ³¹P NMR analysis to identify and quantify the phospholipids in the oil. *Id.* at 31:47–49. Table 22² shows the phospholipid profiles for the raw material, the final product, and a commercially available krill oil, Neptune Krill Oil (“NKO”). *Id.* at 32:6–9. Table 22 is reproduced below:

² We view reference in the '877 patent to “table 25” (Ex. 1001, 32:6–9) to be an inadvertent typographical error, as the specification does not include a table 25. We understand Example 8 of the specification to refer, instead, to Table 22, which sets forth the described phospholipid profiles.

TABLE 22

Phospholipid profiles			
	Type B krill powder	NKO	Krill Oil obtained in Example 7
PC	66.0	68.6	75.3
AAPC	12.0	7.0	13.0
PI			
1LPC	1.2	1.3	0.4
PS			
2LPC	7.4	13.8	2.9
LAAPC	2.2	1.2	0.9
PE	6.0	3.4	3.4
AAPE			1.5
SM			
GPC		1.3	
DHSM			
NAPE		3.4	
CL	5.3		2.1
LPE			0.5
LCL			
% PL in powder or lipid sample	8.3	30.0	47.9

Id. at 32:15–39.

The '877 patent teaches that the “main polar ether lipids of the krill meal are alkylacylphosphatidylcholine (AAPC) at 7–9% of total polar lipids, lyso-alkylacylphosphatidylcholine (LAAPC) at 1% of total polar lipids (TPL) and alkylacylphosphatidyl-ethanolamine (AAPE) at <1% of TPL.”

Id. at 32:9–14.

C. Illustrative Claim

Of the challenged claims, claims 1 and 11 are independent. Claim 1, reproduced below, is illustrative of the claimed subject matter.

1. A method of production of krill oil comprising:
 - a) providing krill;
 - b) treating said krill to denature lipases and phospholipases in said krill to provide a denatured krill product; and
 - c) extracting oil from said denatured krill product with a polar solvent to provide a krill oil with from about 3% to about 10% w/w ether phospholipids; from about 27% to 50% w/w non-ether phospholipids so that the amount of total phospholipids in said krill oil is about 30% to 60% w/w; and from about 20% to 50% w/w triglycerides, wherein said steps a and b are performed on a ship.

Ex. 1001, 34:59–35:2. Claim 11 requires that the krill oil produced by the method recited includes amounts of phospholipid components and triglycerides within the same ranges as claim 1. *Id.* at 35:23–36:7.

D. Prior Art Relied Upon

Petitioner relies upon the following as prior art references (Pet. 8–9):

Breivik	US 2010/0143571 A1	June 10, 2010	(Ex. 1035)
Catchpole	WO 2007/123,424	Nov. 1, 2007	(Ex. 1009)
Sampalis	WO 03/011873 A2	Feb. 13, 1003	(“Sampalis II”) (Ex. 1013)

Bottino, *The Fatty Acids of Antarctic Phytoplankton and Euphausiids. Fatty Acid Exchange Among Trophic Levels of the Ross Sea*, 27 MARINE BIOLOGY 197–204 (1974) (Ex. 1007).

Fricke et al., *Lipid, Sterol and Fatty Acid Composition of Antarctic Krill (Euphausia superba Dana)*, 19(11) LIPIDS 821–827 (1984) (“Fricke 1984”) (Ex. 1010).

Sampalis et al., *Evaluation of the Effects of Neptune Krill Oil™ on the Management of Premenstrual Syndrome and Dysmenorrhea*, 8(2) ALT. MED. REV. 171–179 (2003) (“Sampalis I”) (Ex. 1012).

Petitioner also relies on the Declaration of Stephen J. Tallon, Ph.D. (Ex. 1006), and the Reply Declaration of Dr. Tallon (Ex. 1086).

Patent Owner relies on the Declaration of Nils Hoem, Ph.D. (Ex. 2001).

E. Instituted Challenges

We instituted trial based on each challenge to the patentability of the '877 patent presented in the Petition (Pet. 6–7):

Claims	Basis	References
1–3, 6, 8, 9, 11, 12, 15, 17, and 18	§ 103(a)	Breivik, Catchpole, and Fricke 1984
4, 5, 13, and 14	§ 103(a)	Breivik, Catchpole, Fricke 1984, and Bottino
7 and 16	§ 103(a)	Breivik, Catchpole, Fricke 1984, and Sampalis I
10 and 19	§ 103(a)	Breivik, Catchpole, Fricke 1984, and Sampalis II

II. ANALYSIS

A. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Petitioner asserts that a person of ordinary skill in the art at the time of the invention of the '877 patent would have had “an advanced degree in marine sciences, biochemistry, organic (especially lipid) chemistry, chemical or process engineering, or associated sciences,” as well as a complementary understanding of “organic chemistry and in particular lipid chemistry, chemical or process engineering, marine biology, nutrition, or associated sciences; and knowledge of or experience in the field of

extraction,” in addition to “at least five years applied experience.” Pet. 5–6; Ex. 1006 ¶ 27.

Patent Owner does not address the level of ordinary skill in its Response; however, Patent Owner’s declarant, Dr. Hoem opines that the definition proposed by Petitioner “is consistent with the literature, credentials of individuals working on lipid extractions, and the skill necessary to perform these extractions and interpret their results” Ex. 2001 ¶ 15. Based on that assessment, Dr. Hoem adopts the definition of the level of ordinary skill in the art advanced by Petitioner. *Id.*

We agree with Petitioner, Dr. Tallon, and Dr. Hoem, and find that Petitioner’s description of the level of ordinary skill in the art at the time of invention of the ’877 patent is consistent with the type of problems encountered in the art, prior art solutions to those problems, rapidity with which innovations are made, sophistication of the technology, and educational level of active workers in the field. *See In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). For purposes of this Decision, therefore, we adopt Petitioner’s description. We also note that the applied prior art reflects a level of skill at the time of the claimed invention consistent with our determination. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

In addition, we recognize each of Petitioner’s and Patent Owner’s declarants as qualified to provide the proffered opinions on the level of skill and the knowledge of a person of ordinary skill in the art at the time of the invention. The relative weight that we assign such testimony, however, is subject to additional factors. *See, e.g.*, 37 C.F.R. § 42.65(a) (“Expert

testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,763 (Aug. 14, 2012) (same).

B. Claim Construction

In an *inter partes* review, the Board interprets claim terms in an unexpired patent according to the broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016) (affirming applicability of broadest reasonable construction standard to *inter partes* review proceedings). Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention, in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only those terms that are in controversy need be construed, and only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Although both Petitioner (Pet. 19–30) and Patent Owner (PO Resp. 11–13) offer several claim constructions, we determine that no explicit construction of any claim term is necessary for purposes of this Decision. In reaching this conclusion, we observe that the parties’ proposed constructions are largely coextensive with each other, and to the extent those constructions differ, they do so in ways that do not impact our analysis. For example, our

analysis below remains the same irrespective of whether we apply Petitioner's construction of "krill oil" as meaning "lipids extracted from krill" (Pet. 21) or Patent Owner's interpretation, "oil produced from krill" (PO Resp. 12). Similarly, our analysis is unaffected by whether we apply Petitioner's definition of "to denature lipases and phospholipases," i.e., "to alter the conformational structure of lipases and phospholipases to reduce lipid and phospholipid decomposition" (Pet. 24), or Patent Owner's construction, "to treat the lipases and phospholipases to rupture hydrogen bonds thereby changing the molecular structure of the lipases and phospholipases" (PO Resp. 12).³

³ Patent Owner expressly accepts, for purposes of this proceeding, Petitioner's proposed constructions of "polar solvent," "freshly harvested krill," and "polar entrainer," the remaining terms for which the parties propose constructions. PO Resp. 13.

C. Overview of the Prior Art

Petitioner relies on combinations including Breivik, Catchpole, Fricke 1984, Bottino, Sampalis I, and/or Sampalis II to support its contention that claims 1–19 of the '877 patent would have been obvious. Pet. 6–7. Patent Owner asserts that Fricke 1986,⁴ Tanaka,⁵ Prescott,⁶ and Zimmerman⁷ support its argument that an ordinarily skilled artisan would not have made Petitioner's proposed combinations, and further, that the prior art teaches away from the encapsulation of krill oil with high levels of ether phospholipids. *See, e.g.*, PO Resp. 14–20, 23–26. We provide an overview of each reference below.

1. Breivik

Breivik “relates to a process for preparing a substantially total lipid fraction from fresh [kr]ill, and a process for separating phospholipids from the other lipids.” Ex. 1035 ¶ 1. According to Breivik, approximately 50%

⁴ Fricke et al., *1-O-Alkylglycerolipids in Antarctic Krill (Euphausia Superba Dana)*, 85B COMP. BIOCHEM. PHYSIOL. 131–134 (1986) (“Fricke 1986”) (Ex. 2006).

⁵ Tanaka et al., *Platelet-Activating Factor (PAF)-Like Phospholipids Formed During Peroxidation of Phosphatidylcholines from Different Foodstuffs*, 59(8) BIOSCI. BIOTECH. BIOCHEM. 1389–1393 (1995) (Ex. 1014).

⁶ Prescott et al., *Platelet-Activating Factor and Related Lipid Mediators*, 69 ANNU. REV. BIOCHEM. 419–45 (2000) (Ex. 2003).

⁷ Zimmerman et al., *The Platelet-Activating Factor Signaling System and Its Regulators in Syndromes of Inflammation and Thrombosis*, 30 CRIT. CARE MED. S284–S301 (2002) (Ex. 2004).

of the lipids in *E. superba* are phospholipids, and oil extracted from *E. superba* contains lower amounts of environmental pollutants than traditional fish oils. *Id.* ¶¶ 6–7. Breivik notes that krill lipases remain active after the krill is dead, and, thus, krill oil may contain an undesired amount of free fatty acids, making it desirable to use a process that will provide for a low degree of hydrolysis of the krill lipids. *Id.* ¶ 8.

Breivik teaches that its lipid extraction process “requires a minimum of handling of the raw materials, and is well suited to be used on fresh [kr]ill, for example onboard the fishing vessel.” Ex. 1035 ¶ 15. According to Breivik, the process includes an optional heat pre-treatment of the krill to inactivate enzymatic decomposition of the lipids, ensuring a product with a low level of free fatty acids. *Id.*

Breivik describes an extraction process in which fresh krill is washed with ethanol, and the ethanol washed krill is then extracted with supercritical CO₂ containing 10% ethanol. Ex. 1035 ¶¶ 39–40. Breivik also discloses a process in which the raw material is heated at 80°C for 5 minutes before the first wash with ethanol. *Id.* ¶ 47. According to Breivik, “heat-treatment gives an increased yield of lipids compared to the same treatment with no heating.” *Id.* ¶ 51.

2. Catchpole

Catchpole discloses “a process for separating lipid materials containing phospholipids” (Ex. 1009, 1:5–6) in order to produce a product containing “desirable levels of particular phospholipids” (*id.* at 3:27–28). Catchpole states that phospholipids “have been implicated in conferring a

number of health benefits including brain health, skin health, eczema treatment, anti-infection, wound healing, gut microbiota modifications, anti-cancer activity, alleviation of arthritis, improvement of cardiovascular health, and treatment of metabolic syndromes. They can also be used in sports nutrition.” *Id.* at 1:29–2:2. Catchpole further discloses that products having high levels of particular phospholipids “may be employed in a number of applications, including infant formulas, brain health, sports nutrition and dermatological compositions.” *Id.* at 25:9–13.

Catchpole describes, in Example 18, the fractionation of krill lipids from krill powder using a process that employs supercritical CO₂ in a first extraction, and a CO₂ and absolute ethanol mixture in a second. *Id.* at 24:1–16. Table 16, reproduced below, reports the phospholipid concentrations present in the krill oil extract obtained by Catchpole. *Id.* at Table 16.

Table 16

	Yield % of feed	Composition, %							Other compounds
		PC	PI	PS	PE	CL	AAPC	AAPE	
Feed		6.6	0.0	0.0	0.4	0.1	0.6	0.1	78.6
Extract 2	4.3	39.8	0.0	0.0	0.3	0.2	4.6	0.2	53.7
Residue	79.2	3.6	0.0	0.0	0.3	0.2	0.5	0.1	93.4

As shown in Table 16, the composition of Extract 2 includes 39.8% phosphatidylcholine (“PC”). *Id.* The ether phospholipids alkylacylphosphatidylcholine (“AAPC”) and alkylacylphosphatidylethanolamine (“AAPE”) were also present in Extract 2, representing 4.6% and 0.2%, respectively, of the extracted composition. *Id.* In addition, summing each of the reported phospholipid

amounts reported for Extract 2 yields a total phospholipid concentration of 45.1%. *Id.*

3. *Fricke 1984*

Fricke 1984 discloses the “lipid classes, fatty acids of total and individual lipids and sterols of Antarctic krill (*Euphausia superba* Dana) from two areas of the Antarctic Ocean” as determined by thin layer chromatography, gas liquid chromatography, and gas liquid chromatography/mass spectrometry analyses. Ex. 1010, Abstract. According to Fricke 1984, krill were collected and were quick frozen, and lipids were extracted using the method of Folch.⁸ *Id.* at 1. Fricke 1984 teaches further that samples were also cooked on board “immediately after hauling,” and were stored under the same condition. *Id.* at 2–3.

⁸ Folch et al., *A Simple Method for the Isolation and Purification of Total Lipides from Animal Tissues*, 266 J. BIOL. CHEM. 497–509 (1957) (Ex. 1017).

Table 1 of Fricke 1984 is reproduced below.

TABLE 1		
Lipid Composition of Antarctic Krill (<i>Euphausia superba</i> Dana)		
Sample	12/1977	3/1981
Total lipid content (% wet weight)	2.7 ± 0.2	6.2 ± 0.3
<u>Phospholipids</u>		
Phosphatidylcholine	35.6 ± 0.1	33.3 ± 0.5
Phosphatidylethanolamine	6.1 ± 0.4	5.2 ± 0.5
Lysophosphatidylcholine	1.5 ± 0.2	2.8 ± 0.4
Phosphatidylinositol	0.9 ± 0.1	1.1 ± 0.4
Cardiolipin	1.0 ± 0.4	1.6 ± 0.2
Phosphatidic acid	0.6 ± 0.4	
<u>Neutral lipids</u>		
Triacylglycerols	33.3 ± 0.5	40.4 ± 0.1
Free fatty acids ^a	16.1 ± 1.3	8.5 ± 1.0
Diacylglycerols	1.3 ± 0.1	3.6 ± 0.1
Sterols	1.7 ± 0.1	1.4 ± 0.1
Monoacylglycerols	0.4 ± 0.2	0.9 ± 0.1
Others ^b	0.9 ± 0.1	0.5 ± 0.1
Total	98.9	99.3

Table 1 shows the total lipid content and the lipid composition data for the two krill samples analyzed by Fricke 1984. *Id.* at 2. As indicated in Table 1, the krill samples respectively included approximately 33.3% +/- 0.5% w/w and 40.4% +/- 0.1% w/w triacylglycerols. *Id.*

4. Bottino

Bottino observes that “[t]he study of krill has become intensive in recent times, perhaps as a result of its potential importance as food,” and explains that “[a] variety of organisms [are] usually included under that generic name, but in the Southern Oceans the name *Euphausia superba* has been considered almost a synonym for krill.” Ex. 1007, 1.

Bottino describes the fatty acid profiles for *E. superba*, *E. crystallorophias*, and phytoplankton. Ex. 1007, Abstract. Bottino explains

that, in contrast to prior studies, lipids were extracted from *E. superba* “immediately after capture.” *Id.* at 2. Euphausiids lipid extraction was performed “with a chloroform:methanol (2:1, v/v) mixture,” as previously described by Folch, and the fatty acids were analyzed using chromatography. *Id.* at 1.

Table 1 of Bottino is reproduced below.

Table 1. *Euphausia superba*. Fatty acids (as weight per cent of total acids)

Fatty acid ^a	Station 8		Station 9		Station 11	
	Whole krill	HP+S ^b	Whole krill	Whole krill	HP+S	Remaining carcass
14:0	14.9	10.7	12.9	14.3	12.9	13.5
16:0	21.2	21.2	20.9	24.7	22.3	23.4
18:0	0.7	1.2	0.9	1.4	1.3	1.4
16:1(n-7)	9.0	6.7	10.7	8.9	8.2	8.0
18:1(n-9)	18.2	17.1	22.8	21.7	21.8	21.5
20:1(n-9)	0.6	0.9	1.1	0.9	1.2	1.1
18:2(n-3)	2.6	2.5	2.7	2.0	2.1	1.9
18:3(n-3)	1.1	1.2	1.4	1.0	1.0	1.1
18:4(n-3)	2.2	1.9	2.6	3.3	3.6	3.8
20:5(n-3)	16.0	22.2	11.8	11.4	13.9	11.6
22:6(n-3)	8.6	9.4	8.3	7.3	8.1	9.4
Minor fatty acids ^c	4.9	5.0	3.9	3.1	3.6	3.3

^aThe number preceding the colon gives the number of carbon atoms in the chain, the number following the colon the number of double bonds; (n-x): number of carbons in the chain minus number of carbons between the methyl end and the nearest double bond.

^bHepatopancreas plus stomach.

^cOnly those fatty acids present at a level of 1% or more are included.

Ex. 1007, Table 1. Table 1 discloses the fatty acid content of *E. superba* obtained from three different locations (i.e., stations) as a weight percent of total fatty acids. *Id.* at 2. Notably, only those fatty acids present at 1% or

more as a weight percent of total fatty acids are included in Table 1. *Id.*

Table 1 n.c.

Table 3 of Bottino is reproduced below.

Table 3. Fatty acids of Antarctic phytoplankton and euphausiids (as weight per cent of total acids)

Fatty acid	Phytoplankton at Stations ^a												<i>Euphausia superba</i> (average of 3 stations)	<i>Euphausia crystallographica</i> (average of 7 stations)
	8	9a	9b	11a	11b	13	14	15a	15b	15c	18a	18b		
8:0	-	-	-	0.4	-	1.2	1.0	-	-	0.7	-	-	-	-
9:0	0.2	0.3	2.9	0.9	0.2	1.4	2.5	1.5	0.1	1.7	-	-	-	0.2
10:0	-	1.5	-	1.7	-	0.9	4.0	2.4	0.1	2.2	-	-	-	-
11:0	-	-	-	0.7	1.3	1.2	1.9	1.1	trace	0.3	-	-	-	-
12:0	1.3	2.3	2.3	1.9	0.4	2.0	2.2	2.5	0.4	0.8	0.2	-	0.2	0.1
13:0	-	1.1	-	-	-	0.4	3.0	0.8	-	-	-	-	-	0.1
14:0	9.7	22.5	11.5	15.9	22.9	25.5	20.7	17.4	19.3	5.1	13.0	9.5	14.0	2.4
15:0	1.9	0.3	1.6	2.6	1.7	2.6	-	3.4	0.7	1.1	0.3	-	0.4	0.1
16:0	20.4	20.1	19.9	16.0	18.8	21.7	18.5	18.7	17.2	16.1	17.3	14.9	22.3	14.6
18:0	7.0	2.1	3.3	2.0	2.0	2.6	2.2	1.9	1.8	5.2	1.7	1.5	1.0	0.5
10:1(n-7)	0.6	2.2	2.5	-	0.8	-	-	-	-	-	0.2	-	-	-
11:1(n-7)	-	-	-	0.7	-	1.9	2.0	1.3	0.1	0.9	-	-	-	-
12:1(n-7)	-	2.8	1.5	1.6	2.4	0.7	1.2	1.6	0.2	0.9	1.5	0.3	-	-
13:1(n-7)	-	0.5	-	1.0	-	0.6	1.8	1.4	0.1	1.1	-	-	-	-
15:1(n-7)	0.5	0.7	0.6	1.3	0.6	1.2	1.0	2.7	0.4	0.7	1.8	-	trace	-
16:1(n-7)	12.4	8.3	7.5	6.2	5.7	5.3	3.4	7.8	3.6	3.2	13.1	10.3	9.5	7.9
17:1(n-7)	1.6	0.3	0.9	0.6	0.3	0.2	-	0.3	0.3	trace	1.4	0.9	0.5	0.3
18:1(n-9)	12.1	16.0	15.6	16.2	18.3	16.3	24.8	11.4	20.2	12.5	12.3	18.7	20.8	46.2
20:1(n-9)	0.4	-	0.8	trace	-	1.7	-	0.1	trace	-	0.3	0.3	0.9	0.2
18:2(n-6)	2.1	0.1	0.3	0.2	0.1	-	-	-	0.1	-	4.1	3.8	0.2	-
18:2(n-3)	3.7	3.3	2.4	3.1	3.3	3.0	2.7	2.1	7.1	12.0	1.2	1.7	2.4	2.1
22:2(n-6)	-	-	-	-	-	0.8	0.9	1.6	2.0	-	-	-	-	-
22:2(n-3)	-	0.6	0.7	1.4	1.4	-	-	-	-	-	-	-	-	-
18:3(n-6)	0.3	0.3	0.3	0.2	0.2	-	-	-	0.2	0.3	0.2	0.3	0.2	0.1
18:3(n-3)	0.9	0.7	0.6	0.7	0.7	0.7	0.3	0.2	0.1	0.2	0.2	0.3	1.2	0.9
20:3(n-6)	0.4	0.2	-	trace	0.9	trace	-	0.3	2.6	0.1	-	0.1	-	-
20:3(n-3)	0.2	0.2	0.3	-	-	-	-	trace	0.9	1.0	-	0.2	0.5	0.3
16:4(n-1)	-	-	0.5	-	-	-	-	-	-	6.3	-	-	-	-
18:4(n-3)	2.0	3.1	3.5	5.2	6.0	3.0	2.7	3.2	6.2	0.9	2.2	2.5	2.7	1.2
20:4(n-6)	-	-	-	0.4	-	-	-	-	-	4.7	-	-	0.4	0.4
20:4(n-3)	0.2	-	0.3	0.2	-	-	-	0.1	trace	-	-	0.2	0.4	0.1
22:4(n-6)	-	-	-	-	-	-	-	-	-	trace	-	-	0.2	-
22:4(n-3)	1.3	-	trace	-	-	-	-	trace	-	trace	-	-	-	-
20:5(n-3)	11.4	4.8	9.2	7.0	6.4	1.7	2.1	5.3	6.0	2.1	18.4	23.4	13.1	14.4
22:5(n-6)	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-
22:5(n-3)	0.3	0.3	-	-	-	-	-	0.1	-	2.1	-	-	0.2	-
22:6(n-3)	6.1	4.9	7.9	8.4	5.5	0.9	0.8	7.1	7.8	16.5	5.5	11.0	8.1	7.5
Minor fatty acids ^b	3.3	1.5	4.3	4.6	1.0	3.2	0.6	4.0	2.8	1.8	0.5	0.9	0.8	0.4

^aMicroscopic examination indicated that the following genera predominated in each station. Station 9: *Eudorina*, *Pandorina*; Station 10: *Thalassiosira*, *Fragilaria*, *Nitzschia*, *Corethron*, *Silicoflagellates*; Station 11: *Corethron*, *Fragilaria*, *Chaetoceros*, *Silicoflagellates*; Station 12: *Corethron*, *Fragilaria*, *Nitzschia*, *Tintinnids*; Station 13: Complex mixture; Station 14: *Phaeocystis*; Station 15: *Phaeocystis*, *Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Fragilaria*; Stations 17 and 18: *Fragilaria*, *Nitzschia*, *Coscinodiscus*, *Dinoflagellates*, *Tintinnids*.

^bOnly those fatty acids present at a level of 1% or more are included. See footnotes to Tables 1 and 2 for further explanation.

Ex. 1007, Table 3. Table 3 reports the identity and average amount of each fatty acid present in the *E. superba* samples analyzed as a weight percent of total fatty acids.

5. *Sampalis I*

Sampalis describes a clinical trial “[t]o evaluate the effectiveness of Neptune Krill Oil™ (NKO™) for the management of premenstrual syndrome and dysmenorrhea.” Ex. 1012, 1. Sampalis explains that NKO is “extracted from Antarctic krill also known as *Euphausia superba*. *Euphausia superba*, a zooplankton crustacean, is rich in phospholipids and triglycerides carrying long-chain omega-3 polyunsaturated fatty acids, mainly EPA and DHA, and in various potent antioxidants including vitamins A and E, astaxanthin, and a novel flavonoid.” *Id.* at 4.

Sampalis discloses that each patient in the clinical trial was “asked to take two 1-gram soft gels of either NKO or omega-3 18:12 fish oil (fish oil containing 18% EPA and 12% DHA) once daily with meals during the first month of the trial.” *Id.* Sampalis reports that “[t]he final results of the present study suggest within a high level of confidence that Neptune Krill Oil can significantly reduce the physical and emotional symptoms related to premenstrual syndrome, and is significantly more effective for the management of dysmenorrhea and emotional premenstrual symptoms than fish oil.” *Id.* at 8.

6. *Sampalis II*

Sampalis II discloses a “phospholipid extract from a marine or aquatic biomass [that] possesses therapeutic properties. The phospholipid extract comprises a variety of phospholipids, fatty acid, metals and a novel flavonoid.” Ex. 1013, Abstract. Sampalis II explains that the disclosed phospholipid and its components “are useful in the prevention or treatment of a variety of disease states and for the aesthetic enhancement of an animal, including human, body. Pharmaceutical, nutraceutical and cosmetic compositions containing the extract and uses thereof are also within the invention.” *Id.* at 3:6–11.

Sampalis II further discloses that

[t]he phospholipid extract of the present invention may be extracted from a variety of marine or aquatic biomass sources. Preferred sources of the phospholipid composition are crustaceans, in particular, zooplankton. A particularly preferred zooplankton is Krill. Krill can be found in any marine environment around the world. For example, the Antarctic Ocean (where the krill is *Euphasia superba*), the Pacific Ocean (where the krill is *Euphasia pacifica*), the Atlantic Ocean and the Indian Ocean all contain krill habitats.

Ex. 1013, 25:2–10.

7. *Fricke 1986*

Fricke 1986 teaches that “[s]mall amounts of alkoxy lipids, commonly referred to as glyceryl ethers or ether lipids, are present in the lipids of many marine animals.” Ex. 2006, 1. Fricke notes that “[w]hile investigating the complete lipid composition of Antarctic Krill” in the study reported in Fricke 1984, “there was some evidence for the presence of 1-O-

alkylglycerolipids in trace amounts,” which suggested “that some degradation processes had taken place during storage.” *Id.* Fricke 1986 explains that the samples analyzed in Fricke 1984 “were frozen on board a research vessel in 1977 and 1981 and could only be investigated after some months of frozen storage.” *Id.* Accordingly, Fricke 1986 set out to verify the findings of Fricke 1984, using lipid extracts from freshly caught krill that were prepared on-board during an expedition in 1985. *Id.*

According to Fricke 1986, 1-O-alkylglycerolipids “were found as minor lipid components,” and “ranged from 0.3 to 0.6% of total lipid content of Antarctic Krill” (Ex. 2006, 2) as shown in Table 1, reproduced below.

Table 1. Lipid content and 1-O-alkylglycerol content in total lipids of Antarctic Krill (*Euphausia superba* Dana). Data are expressed as wt % and represent means and standard deviation of at least three separate experiments

	A*	B†	C‡	D‡	E‡	F‡§
Lipid content S	2.7 ± 0.2	6.2 ± 0.3	9.2 ± 0.3	8.3 ± 0.7	10.3 ± 0.4	5.7 ± 0.3
1-O-Alkylglycerol-content	0.43 ± 0.04	0.50 ± 0.02	0.53 ± 0.01	0.65 ± 0.03	0.58 ± 0.03	0.58 ± 0.01

*Krill caught in December 1977.

†Krill caught in March 1981.

‡Krill caught in March/April 1985. Krill samples extracted immediately after catching.

§Krill muscle analyzed.

||On a wet weight basis.

*†Krill samples stored at -30°C.

Id. at Table 1.

With regard to the preparation of the 1977 and 1981 samples, Fricke 1986 teaches that alkylglycerolipids were isolated after stepwise hydrolysis of total lipids. Ex. 2006, 1. Phospholipids and neutral lipids were separated using thin layer chromatography, and phospholipids were incubated with phospholipase C. *Id.* Fricke 1986 teaches that the alkylglycerols were prepared from the phospholipids and neutral lipids by concentrated methanolic hydrochloric acid, and the alkylglycerols were isolated using thin layer chromatography. *Id.* at 1–2. Concerning the 1985 samples, Fricke 1986 explains that those samples were treated “according to

Snyder *et al.* (1971) with Vitride (sodium-di-hydro-bis-(2-methoxyethoxy)-aluminate) to form the free alkylglycerols.” *Id.*

8. Tanaka

Tanaka examines the “PAF-like lipids formed during peroxidation of PCs from hen egg yolk, salmon roe, sea urchin eggs, and krill in an FeSO₄/EDTA/ascorbate system.” Ex. 1014, Abstract. Tanaka discloses the phosphatidylcholine subclasses, and their relative amounts, present in Antarctic krill (*Euphausia superba*) extract. Ex. 1014, 2, 3. Tanaka explains that phosphatidylcholine was purified from crude krill lipid extract using column chromatography and thin layer chromatography. *Id.* at 2. Successive degradations of the purified extract using alkaline and acid hydrolysis were then performed to measure the percentages of phosphatidylcholine subclasses in the extract. *Id.*

Table 1 of Tanaka is reproduced below.

Table I. Subclass Composition of PCs from Food Stuffs

PC	Diacyl	Alkylacyl	Alkenylacyl
		%	
Hen egg yolk	99.2 ± 0.2	0.8 ± 0.1	< 0.1
Salmon roe	98.8 ± 0.2	1.2 ± 0.2	< 0.1
Sea urchin egg	57.5 ± 1.1	41.5 ± 0.3	1.0 ± 0.8
Krill	77.0 ± 1.2	23.0 ± 1.2	< 0.1

Values are means ± SE for four experiments.

Ex. 1014, Table 1. Table 1 shows that the ether phospholipid AAPC accounted for 23.0% +/- 1.2% of the total phosphatidylcholine present in Antarctic krill extract. *Id.* at 3.

Tanaka concludes that although the study “demonstrated the formation of PAF-like phospholipids during peroxidation of PCs from different foodstuffs[,] . . . the occurrence of PAF-like lipids in some stored foods is still speculative and requires further investigation.” Ex. 1014, 5.

9. *Prescott*

Prescott discloses that PAF “is a phospholipid with potent, diverse physiological actions, particularly as a mediator of inflammation.”

Ex. 2003, Abstract. Prescott explains that

[t]he PAF receptor recognizes the *sn*-1 ether bond of PAF, its short *sn*-2 acetyl residue, and the choline head group; alteration of any of these structures greatly decreases signaling through the PAF receptor. Extension of the *sn*-2 acetyl residue by one methylene is without consequence, but extension by two methylenes decreases activity by a factor of 10- to 100-fold, depending on the assay. Extension beyond this results in the loss of signaling through the PAF receptor.

Ex. 2003, 13 (internal citations omitted).

Prescott further discloses that “[o]xidation of complex lipids in reduced systems has defined potential oxidation pathways and products, but whether such oxidizing conditions exist in vivo is problematic, given the unstable nature of the reactive intermediates and the potential of metabolism of the oxidation products.” Ex. 2003, 14.

10. *Zimmerman*

Zimmerman is a review article that teaches that “[t]he PAF signaling system can trigger inflammatory and thrombotic cascades, amplify these cascades when acting with other mediators, and mediate molecular and cellular interactions (cross talk) between inflammation and thrombosis.”

Ex. 2004, Abstract. Zimmerman explains that artificial oxidation of phosphatidylcholines “generates a large series of phospholipids in which the polyunsaturated fatty acid at the *sn*-2 position . . . is fragmented to shorter chain lengths. Some of these oxidized phospholipids have sufficiently short *sn*-2 residues and other structural features that allow them to be recognized by the PAF receptor.” *Id.* at 4–5.

*D. Obviousness Based on
Breivik, Catchpole, and Fricke 1984*

Petitioner asserts that claims 1–3, 6, 8, 9, 11, 12, 15, 17 and 18 are unpatentable under § 103(a) as obvious in view of Breivik, Catchpole and Fricke 1984. Pet. 31–51. Patent Owner disagrees. PO Resp. 14–21.

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and, where presented, (4) objective evidence of nonobviousness. *Graham*, 383 U.S. at 17–18.

“An obviousness determination requires finding both ‘that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan

would have had a reasonable expectation of success in doing so.” *CRFD Research, Inc. v. Matal*, 876 F.3d 1330, 1340 (Fed. Cir. 2017) (quoting *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–1368 (Fed. Cir. 2016)).

In assessing whether an ordinarily skilled artisan would have had reason to combine known elements in order to arrive at the claimed invention, it will often “be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art.” *KSR*, 550 U.S. at 418. A reference may be said to teach away from such combination “when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the [patentee].” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (quoting *Ricoh Co., Ltd. v. Quanta Comput. Inc.*, 550 F.3d 1325, 1332 (Fed. Cir. 2008)). In analyzing whether a reference teaches away from the claimed invention, that reference “must [be] considered for all it taught, disclosures that diverged and taught away from the invention at hand as well as disclosures that pointed towards and taught the invention at hand.” *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 296 (Fed. Cir. 1985) (citation omitted). A reference does not teach away “if it merely expresses a general preference for an alternative invention but does not ‘criticize, discredit, or otherwise discourage’ investigation into the invention claimed.” *DePuy*, 567 F.3d at 1327 (quoting *In re Fulton*, 391

F.3d 1195, 1201 (Fed. Cir. 2004)). Even if a reference is not found to teach away, however, its statements regarding preferences are relevant to a finding regarding whether a skilled artisan would be motivated to combine that reference with another reference. *See Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1051 n.15 (Fed. Cir. 2016) (en banc) (noting that, even if a reference “does not teach away, its statements regarding users preferring other forms of switches are relevant to a finding regarding whether a skilled artisan would be motivated to combine the slider toggle in” that reference with the invention of a second reference).

“The reasonable expectation of success requirement refers to the likelihood of success in combining references to meet the limitations of the claimed invention.” *Intelligent Bio-Sys., Inc.*, 821 F.3d at 1367. A reasonable expectation of success “does not require absolute predictability of success . . . *all that is required is a reasonable expectation of success.*” *In re Kubin*, 561 F.3d 1351, 1360 (Fed. Cir. 2009) (quoting *In re O’Farrell*, 853 F.2d 894, 903–904 (Fed. Cir. 1988)). “What does matter is whether the prior art gives direction as to what parameters are critical and which of many possible choices may be successful.” *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 965 (Fed. Cir. 2014).

*1. Teachings of Breivik,
Catchpole, and Fricke 1984*

Petitioner asserts that Breivik and Fricke 1984 each “disclose providing krill for lipid extraction.” Pet. 32. For example, Petitioner contends that Breivik describes “a process for preparing a substantially total lipid fraction from fresh krill, a process for separating phospholipids from

other lipids, and a process for producing krill meal.” *Id.* at 31 (quoting Ex. 1035, 1; citing Ex. 1006 ¶¶ 184–185, 189). Similarly, Petitioner asserts that Fricke 1984 discloses “obtaining lipids from krill.” *Id.* at 31–32 (citing Ex. 1010, 1;⁹ Ex. 1006 ¶¶ 98–100).

As to the requirement that the krill is treated to denature lipases and phospholipases (claims 1 and 11), Petitioner asserts that Breivik teaches that an “optional pre-treatment involving short-term heating of the fresh krill will also give an inactivation of enzymatic decomposition of the lipids, thus ensuring a product with very low levels of free fatty acids.” Pet. 32 (quoting Ex. 1035 ¶ 15); *see id.* at 36. Petitioner also contends that Fricke 1984 teaches that samples of krill were heated on board immediately after hauling, and that the samples that were heated showed a lower free fatty acid content than those samples that were not heated. *Id.* at 33 (citing Ex. 1010, 2–3), 36–37. Thus, Petitioner asserts, both Breivik and Fricke 1984 teach denaturing using heat, as required by claims 2 and 12. *Id.* at 33–34 (citing Ex. 1006 ¶ 229), 36–37.

In addition, Petitioner’s declarant, Dr. Tallon, testifies that the ordinary artisan would have understood that heating or cooking the krill as taught by Breivik and Fricke 1984 would denature the lipases and phospholipases in the krill, thereby reducing and preventing the decomposition of the lipids and phospholipids in the denatured krill product.

⁹ We understand Petitioner’s reference to Ex. 1035 (Breivik) to be an inadvertent typographical error, as the sentence discusses Fricke 1984, and elsewhere refers to the exhibit number for Fricke 1984.

Ex. 1006 ¶ 229. Given Breivik's and Fricke 1984's teaching that the formation of free fatty acids is reduced by heating the krill after capture, we credit Dr. Tallon's testimony.

Petitioner further contends that Breivik and Fricke 1984 each discloses treating freshly harvested (claims 3 and 11) Antarctic krill (claims 8 and 17), and in particular, *E. superba* (claims 9 and 18) on a ship (claim 1), to obtain a denatured krill product (claims 1 and 11). Pet. 38–39, 44–45, 47–49.

In support of its position, Petitioner notes that Breivik discloses that [a]s the process according to the invention requires a minimum of handling of the raw materials, and is well suited to be used on fresh [krill], for example onboard the fishing vessel, the product according to the invention is expected to contain substantially less hydrolysed and/or oxidised lipids than lipid produced by conventional processes. This also means that there is expected to be less deterioration of the krill lipid antioxidants than from conventional processing.

Pet. 38–39 (quoting Ex. 1035 ¶ 15). Petitioner additionally points out that Breivik defines “fresh krill” to mean “krill that is treated immediately after harvesting or sufficiently short time after harvesting to avoid quality deterioration like hydrolysis or oxidation of lipids, or krill that is frozen immediately after harvesting.” *Id.* at 38–39 (quoting Ex. 1035 ¶ 30); 45.

According to Petitioner, Fricke 1984 similarly teaches that “[s]amples of the same [krill] haul which were cooked on board immediately after hauling and stored under the same conditions showed a FFA content which was much lower, ranging from 1% to 3% of total lipids.” Pet. 39 (quoting Ex. 1010, 2–3).

Concerning the requirements of claims 8, 9, 17, and 18 regarding the particular krill used in the claimed extraction process, Petitioner asserts that Breivik discloses that “[k]rill are small, shrimp-like animals, containing relatively high concentrations of phospholipids. In the group *Euphasiids*, there is more than 80 species, of which the Antarctic krill is one of these. The current greatest potential for commercial utilization is the Antarctic *Euphausia superba*.” Pet. 47–48 (quoting Ex. 1035 ¶ 5). Petitioner further contends that Breivik and Fricke 1984 each disclose the lipid composition of *E. superba*. Pet. 47–48 (citing Ex. 1035 ¶ 6; Ex. 1010, Table 1).

Petitioner asserts that the references also teach the step of extracting the krill oil with a polar solvent (claims 1 and 11), including performing supercritical fluid extraction with a polar entrainer (Claims 6 and 15). According to Petitioner, “[e]xtracting krill oil with a polar solvent is well known.” Pet. 34 (citing Ex. 1035 ¶ 21). In particular, Petitioner relies on Breivik for teaching extracting krill with supercritical CO₂ containing ethanol, and isolating the lipid fraction from the ethanol. *Id.* Petitioner also cites Example 2 of Breivik in which fresh krill was washed with ethanol after pretreating with heat, and the ethanol extract was then subject to supercritical fluid extraction with CO₂ containing 10% ethanol. *Id.* at 34–35 (citing Ex. 1035 ¶ 47).

Petitioner additionally identifies Catchpole as teaching solvent extraction with a polar solvent, that is, supercritical CO₂ containing ethanol, to extract phospholipids from krill. Pet. 35 (citing Ex. 1009, 24:1–18; Ex. 1006 ¶ 96). Petitioner also relies on Fricke 1984 for teaching that lipid

extraction was performed using the method of Folch,¹⁰ noting that Folch discloses extracting the lipid fraction using a 2:1 chloroform-methanol mixture v/v. *Id.* (citing Ex. 1010, 821; Ex. 1017, 497; Ex. 1006 ¶ 232). Petitioner asserts, therefore, that it would have been obvious to the ordinary artisan to use a polar solvent to extract oil from a denatured krill product, and, specifically, to perform supercritical fluid extraction with a polar entrainer. *Id.* at 36.

With regard to the requirements for the composition of the resulting krill oil recited in claims 1 and 11, Petitioner asserts that “[a]ll of the components [of the krill oil product produced by the claimed method] are well-known components of lipids extracted from krill.” Pet. 40.

As to the recitation that the krill oil have 30% to 60% w/w total phospholipids, Petitioner relies on Table 16 of Example 18 of Catchpole as disclosing an extract that includes 45.1% total phospholipids. Pet. 40–41 (citing Ex. 1009,¹¹ 24:1–19, Table 16; Ex. 1006 ¶¶ 95, 96, 234, 235).

Petitioner asserts further that Catchpole discloses a krill oil extract including from about 3% to about 10% w/w ether phospholipids. Pet. 41. In particular, Petitioner points out that Catchpole expressly describes in

¹⁰ Folch et al., *A simple Method for the Isolation and Purification of Total Lipides from Animal Tissue*, 226 J. BIOL. CHEM. 497–509 (1957) (“Folch”) (Ex. 1017).

¹¹ We note that Petitioner actually cites Ex. 1017, even though in the proceeding sentence it refers to Ex. 1009. Pet. 40. We view that reference to Ex. 1017 as a typographical error, and Petitioner intended to refer to Ex. 1009.

Table 16 a krill extract having 4.8% ether phospholipids, including 4.6% AAPC and 0.2% AAPE. *Id.* (citing Ex. 1009, 24:1–19, Table 16; Ex. 1006 ¶¶ 95, 96, 234, 235).

Petitioner also relies on Table 16 of Catchpole to meet the limitation of about 27% to 50% w/w non-ether phospholipids. Pet. 41–42 (citing Ex. 1009, 24:1–19, Table 16). Petitioner notes that the composition of extract 2 has 45.1% total phospholipids, which, as discussed above, includes 4.8% ether phospholipids, and, thus, the remaining lipids would be 40.3% non-ether phospholipids. *Id.* at 41–42 (citing Ex. 1006 ¶¶ 95, 96, 234, 235).

Concerning the claim recitation that the krill extract include from about 20% to 50% w/w triglycerides, Petitioner asserts that Table 1 of Fricke disclosing the lipid composition of Antarctic krill satisfies this claim requirement. Pet. 42–43 (citing Ex. 1010, 822, Table 1; Ex. 1006 ¶¶ 101, 236, 238). Specifically, Petitioner identifies disclosure by Fricke of Antarctic krill samples including 33.3% +/- 0.5% w/w triacylglycerols and 40.4% +/- 0.1% w/w triacylglycerols as meeting this claim element. Pet. 43 (citing Ex. 1010, 822, Table 1).

Having reviewed the cited evidence, and the record as a whole, we find that Petitioner has accurately described the above-stated teachings of Breivik, Catchpole, and Fricke 1984, which we adopt as our own. *See* Pet. 31–57. Indeed, Patent Owner does not challenge Petitioner’s assertion that Breivik, Catchpole, and/or Fricke 1984 discloses each element of challenged claims 1–3, 6, 8, 9, 11, 12, 15, 17, and 18. Instead, the parties’ dispute centers upon whether an ordinarily skilled artisan would have had reason for, and a reasonable expectation of success in, combining Breivik,

Catchpole and Fricke 1984. Thus, our following analysis focuses on that issue.

*2. Rationale to Combine
and Reasonable Expectation of Success*

According to Petitioner, the ordinary artisan would have had a reason to combine the disclosures of Breivik, Catchpole, and Fricke 1984. Pet. 49. In particular, Petitioner notes that Breivik discloses processing freshly caught krill on board a ship by heating, and extracting the krill oil using conventional polar solvents and extraction techniques; that Catchpole also discloses extracting the krill oil using conventional polar solvents and extraction techniques; and that Fricke 1984 notes the importance of reducing lipolytic enzymes to preserve phospholipids and their associated fatty acids, such as omega-3. *Id.* at 49–50. Moreover, Petitioner explains that extracts prepared according to Catchpole are “considered to be more ‘natural’ than extracts produced by other solvents,” and Breivik teaches the use of marine phospholipids in medical products, health food, and in human nutrition. *Id.*

Likewise, Dr. Tallon testifies that the lipid components described in the claims of the ’877 patent “are the natural lipid components in the krill oil that can be extracted using any of a number of conventional solvents,” and that the relative proportions of those lipid components can “be varied in predictable ways by applying a single solvent or combination of solvents . . . to selectively extract specific groups of lipid components . . . , and by blending these selective extracts in known and predictable ways to produce a desired krill oil composition,” indicating that an ordinarily skilled artisan would have had a reasonable expectation of success in making the proposed

combination. Ex. 1006 ¶ 212. Thus, Petitioner contends, the ordinary artisan, “performing the treatment and extraction steps in Breivik, would have been motivated to look to other references such as Fricke and Catchpole to ascertain the components of the krill oil and their amounts as obtained by standard extraction methods.” Pet. 51 (citing Ex. 1006 ¶¶ 28–32, 261).

Patent Owner responds that “[t]he content of lipid extracts made from different starting materials and using different solvents is different and it is not appropriate to combine ranges of components obtained from different methods to provide ranges in a single defined oil.” PO Resp. 15.

Specifically, Patent Owner asserts that an ordinarily skilled artisan at the time of invention of the ’877 patent

would have recognized that it is not scientifically valid to choose one range of a lipid component such as ether phospholipid content and a second range of lipid component such as triglycerides from a second reference and combine those ranges to provide an oil containing those individual ranges, especially when the ranges are derived from references that used different starting materials and different extraction techniques.

Id. 15–16. According to Patent Owner, “the components of [] the oil would depend on the nature of the starting material, storage conditions of the starting material, and the extraction methodology utilized.” *Id.* at 15.

In support of its position, Patent Owner points to a calculation performed by Petitioner’s declarant, Dr. Tallon, in a declaration he submitted in IPR2017-00745,¹² concerning the patentability of the related

¹² IPR2017-00745, Declaration of Stephen J. Tallon, Ph.D. (Ex. 1006).

'905 patent. PO Resp. 16. According to Petitioner, Dr. Tallon provides an erroneous calculation of the ether phospholipid content of the krill oil disclosed in Fricke 1984 in IPR2017-00745. *Id.* Petitioner asserts that Dr. Tallon's calculation in that case exemplifies why an ordinarily skilled artisan would not have made the combination proposed by Petitioner in this one. *Id.*

In IPR2017-00745, Dr. Tallon applies the ratio of AAPC content to total phospholipid content found by Tanaka, a reference on which Petitioner relies in that case, to determine the ether phospholipid content of Fricke 1984, which discloses only total phospholipid content. IPR2017-00745, Ex. 1006 ¶ 98. Dr. Tallon calculates that the ether phospholipid content of Fricke 1984's extract is 7.8%. *Id.* According to Patent Owner, however, Dr. Tallon's calculations are contradicted by the ether phospholipid levels reported in Fricke 1986 for the same samples analyzed in Fricke 1984:

the reported ether phospholipid content of the Fricke samples is at most 0.65% of total lipids for the 1985 sample, and 0.43% and 0.50% respectively for the 1977 and 1981 samples. These values are over 10 times less than the amount calculated by Dr. Tallon and well below the claimed range of 3–10% ether phospholipids.

PO Resp. 18 (citing Ex. 2001 ¶ 36).

Patent Owner contends that the above discussion of the data reported by Fricke 1986 demonstrates why the ordinary artisan would not take a value or range of krill lipids from one reference wherein the krill oil is produced by one method, and then combine it with a value or range of different krill lipids from another reference wherein the krill oil is produced

by a different method. PO Resp. 18 (citing Ex. 2001 ¶ 36). Patent Owner additionally asserts that

the fact that the Fricke 1984 krill oil actually contained at most about 0.6% w/w ether phospholipids as compared to 4.8% in the Catchpole extracts underscores the incompatibility of the Catchpole and Fricke 1984 and the fact that the references cannot be simply merged to provide a krill oil with the claimed components when the starting materials and extraction methodologies are different.

Id. at 19.

Patent Owner further asserts that Petitioner's expert, Dr. Tallon, admitted during cross-examination "that factors such as the extraction process utilized and how the krill starting material is handled and processed influence the phospholipid profile." PO Resp. 20 (citing Ex. 2008, 58:14–60:25. According to Patent Owner:

These many factors that influence the lipid makeup of an extract are not a finite number of predictable factors, but rather a complex set of factors that produce untold numbers of possible combinations, whose unpredictable consequence must be determine empirically. These include, but are not limited to, the krill species and subtype used; the geographic region it is harvested from; the time of year harvested; the harvesting technique used; the manner in which the krill is stored prior to processing; the amount of time the krill is stored prior to processing; the prepressing steps, such as heating and cooling and the time and temperatures involved; the time and manner in which a pre-processed material is handled, such as freeze-drying; whether the material is washed, and the manner in which it is washed, such as solvent selection; the nature of the lipid extraction process used including the number and identity of solvents used, the number and order of the extraction steps, and the concentrations of solvents used; the extraction technology

employed; and the manner in which a lipid extract is stored and handled.

Id.

On Reply, Petitioner responds that the ether phospholipid levels reported in Fricke 1986 are internally inconsistent and artificially low. Reply 10. Namely, Petitioner contends that Fricke 1986 did not directly measure the ether phospholipid content of the krill oil tested, but rather, quantified the amount present of a lower molecular mass degradation product after successive degradation steps (*id.* 6–8 (citing Ex. 1086 ¶ 67–69)), using an imprecise measurement technique that was less accurate than the techniques employed by Catchpole and Tanaka (*id.* at 8–11 (citing Ex. 1006 ¶¶ 94, 134–135; Ex. 1086 ¶¶ 71–74, 79; Ex. 1009, 14; Ex. 1014, 2)). According to Petitioner, an ordinarily skilled artisan

would have a compelling reason to rely upon the results obtained using a more precise analytical technique, such as NMR, and disregard Fricke [1986]’s outdated and inaccurate method which failed to directly measure ether phospholipid content or differentiate between ether phospholipids and other possible sources of ether lipids in the samples analyzed.

Reply 8–9 (citing Ex. 1086 ¶ 71).

Petitioner further contends that Patent Owner’s arguments concerning the potential for variability resulting from the extraction techniques employed and the starting material used are misplaced. Reply 11–15. Petitioner asserts lipid extraction techniques, as well as solvent extraction techniques using supercritical CO₂ and supercritical CO₂ with a polar entrainer were well-known, and that an ordinarily skilled artisan would have “appreciated that extraction conditions could be modified to predictably

extract different lipid components, and that different fractions could be extracted separately or blended with other fractions to arrive at a desired krill oil composition.” Reply 11–12 (citing Ex. 1006 ¶¶ 87–96, 137–143; Ex. 1086 ¶¶ 102–103).

Similarly, Petitioner asserts that an ordinarily skilled artisan “would have been well aware of numerous studies detailing how the lipid content and components of these lipids may fluctuate based upon the species of krill or where and when the krill is caught” and would have recognized that *E. superba* consisted of “approximately 2–3% lipids by wet weight, of which 30–50% by weight was phosphatidylcholine.” Reply 12–13 (citing Ex. 1006 ¶¶ 119–122; Ex. 1086 ¶¶ 87–91).

Petitioner likewise contends that the effects of krill harvesting, storage, and pre-processing techniques were also well studied, predictable and understood by an ordinarily skilled artisan. Reply 14 (citing Ex. 1086 ¶¶ 93–101). In addition, Petitioner represents that such an artisan

would have recognized that once denatured, a number of conventional extraction techniques could be implemented to predictably take into account any seasonal or geographic fluctuations in the composition of the natural krill starting material so that there would have been a reasonable expectation of obtaining krill oil as recited by the claims of the ‘877 patent.

Id. (citing Ex. 1086 ¶¶ 92, 107–108).

Based on our review of the record as a whole, we determine that a preponderance of the evidence supports Petitioner’s contention that an ordinarily skilled artisan would have had reason for, and a reasonable expectation of success in, combining Catchpole, Sampalis, and Fricke 1984

to arrive at invention of claims 1–3, 6, 8, 9, 11, 12, 15, 17, and 18. We address Patent Owner’s arguments below.

As to Patent Owner’s argument that the proposed combination of Breivik, Catchpole, and Fricke 1984 is scientifically unsupportable, we do not agree. Catchpole and Fricke 1984 each teach a method of extracting oil from krill using a step of extracting the krill oil with a polar solvent. Further, Catchpole teaches a krill oil that is from about “3% to about 10% w/w ether phospholipids; and from about 27% to 50% w/w non-ether phospholipids so that the amount of total phospholipids [in said krill oil] is about 30% to 60% w/w” (Ex. 1001, 35:60–36:16, 36:30–36, 36:49–56), as required by the challenged claims. Ex. 1009, 24 (Table 16). Catchpole does not report an amount of triglycerides in its product, but notes that compounds other than those listed make up 53.7% of the lipid extract.

In order to determine the amount of triglycerides that may be in the extract, we agree with Petitioner that the ordinary artisan would have looked to other references, such as Fricke 1984, that reported the amount of triglycerides in the extract (Pet. 42, 51). Fricke 1984, in Table 1, reports that the 33.3% and 40.4%, respectively, of the lipid composition of the *E. superba* samples tested is attributable to triacylglycerols. Ex. 1010, Table 1. The ordinary artisan would understand that the amount of triglycerides reported by Fricke 1984 is consistent with the amount of additional compounds—which includes triacylglycerols—reported by Catchpole for extract 2. *Compare* Ex. 1010, Table 1 *with* Ex. 1009, Table 16. In this regard, we note Dr. Tallon’s testimony that an ordinarily skilled artisan would have expected the “other compounds” fraction of

Catchpole's extract 2 "to comprise mainly triglycerides, and smaller amounts of free fatty acids, partial glycerides and other minor lipid and lipid-soluble compounds – with the amount of triglycerides likely to be less than 50% by weight of krill oil." Ex. 1006 ¶ 92.

To the extent that Patent Owner argues that the ordinary artisan would not look to different references to provide a single defined krill oil, none of the challenged claims requires a single defined krill oil. That is, claims 1 and 11 specify ranges of "from about 3% to about 10% w/w ether phospholipids; from about 27% to 50% w/w non-ether phospholipids so that the amount of total phospholipids in [said] krill oil is about 30% to 60% w/w; and from about 20% to 50% w/w triglycerides." Ex. 1001, 34:63–35:2, 36:1–7.

Because Catchpole describes a natural krill extract, but does not expressly discuss the triglyceride content of that extract, we determine that an ordinarily skilled artisan would have turned to other references that likewise describe components of a natural krill extract to deduce the approximate amount of triglycerides present in Catchpole. In this regard, we credit Dr. Tallon's testimony that "[t]he typical range of natural variation in krill composition was well known to the POSITA, and the outcome of the different handling and processing steps was well understood in the prior art." Ex. 1086 ¶ 86 Further, as explained above, Catchpole states that the percentage of other compounds in Extract 2 is 53.7%, indicating that, at a maximum, the amount of triglycerides present can be no more than 53.7%, which is consistent with the triglyceride levels reported in Fricke 1984.

Neither are we persuaded by Patent Owner's contention that Dr. Tallon's purportedly erroneous calculation of the ether phospholipid levels in Fricke 1984 in IPR2017-00745 illustrates the folly of attempting to combine ranges or values from one source produced by a particular analytical method (e.g., Fricke 1984), and combine that data with ranges or values obtained from another source (e.g., Tanaka), produced by a different method, produced by a different method.

As an initial matter, we note that we do not rely on Dr. Tallon's calculation of the amount of ether phospholipids present in Fricke 1984 in this Decision. Accordingly, to the extent that calculation is deficient, we observe that any such deficiencies are not implicated here.

Moreover, we find that an ordinarily skilled artisan confronted with the ether phospholipid levels reported by Catchpole would not have given credence to the ether phospholipid levels reported in Fricke 1986's analysis of the samples originally described in Fricke 1984 because, at the time of invention of the '877 patent, the quantification method of Fricke 1986 would have been recognized as less accurate than, and outdated relative to, the ³¹P NMR results disclosed by Catchpole. Stated differently, although Fricke 1984, a reference upon which Petitioner relies for this ground of unpatentability, employs a known and reliable technique for assessing *total phospholipid* levels, the method used in Fricke 1986 to quantify *ether phospholipid* levels would have been recognized as less accurate and outdated relative to ³¹P NMR, as used by Catchpole. As such, an ordinarily

skilled artisan would not have looked to Fricke 1986 to discern the ether phospholipid levels of the samples first reported in Fricke 1984.¹³

As Petitioner points out, Fricke 1986 does not directly measure ether phospholipids. Reply 6–8 (citing Ex. 1086 ¶¶ 63–69). Instead, as Dr. Tallon explains,

[t]he compound quantified, 1-O-alkyleglycerol, is a degraded version of the original ether lipids from which it is derived, containing no phospholipid head group and no acyl group on the sn-2 position. This molecule has a significantly smaller molecular mass than that of the krill ether phospholipids in their natural form in krill oil.

Ex. 1086 ¶ 67. Because Fricke 1986 reports, as a weight percent, the amount of a degraded ether phospholipid, we credit Dr. Tallon’s testimony that the values reported by Fricke 1986 are lower than typical ether contents observed in krill (Ex. 1086 ¶ 67).

We also credit Dr. Tallon’s testimony that because the method of ether phospholipid quantification employed by Fricke 1986 “depends on the successive degradation of the natural ether phospholipid into a glycerolipid with only the ether linked fatty acid remaining, and then further to an isopropylidene derivative,” there are numerous steps in which “losses of the final quantifiable compound could occur including but not limited to limited selectivity of the phospholipase conversion” (Ex. 1086 ¶ 69). In contrast to Fricke 1986, Catchpole directly quantifies ether phospholipids using

¹³ For clarity, we highlight that Fricke 1984 does not suffer from the deficiencies of Fricke 1986, because Fricke 1984 does not rely on the method of ether phospholipid quantification employed by Fricke 1986. *Compare* Ex. 1010, 1–2 *with* Ex. 2006, 1–2.

³¹P NMR (Ex. 1009, 14:7–8), a technique that Dr. Hoem, Patent Owner’s declarant, recognizes as the preferred method for analyzing the components of krill oil. Ex. 1079, 1, 3–4, 11;¹⁴ Ex. 1090, 97:23–98:5; Ex. 1086 ¶¶ 72–74). Although not prior art, it is notable that Dr. Hoem is named as a coauthor on a paper that touts the superiority of ³¹P NMR relative to other analytical techniques, and concludes that ³¹P NMR “spectra gave more detailed information on the PL [(phospholipid)] and FA [(fatty acid)] composition of krill oil than what could have been obtained by other analytical techniques.” Ex. 1079, 1, 12.

In view of the limitations of Fricke 1986, we likewise credit Dr. Tallon’s testimony that

[t]he ether lipid content values reported by Fricke [1986] are lower than the range of typical ether lipid content seen in krill in both my own experience and in the consensus of more recent analysis reported by others, which demonstrates that Fricke [1986]’s analysis is indeed non-representative.

Ex. 1086 ¶ 69 (internal citation omitted). Indeed, Patent Owner’s declarant, Dr. Hoem acknowledges that he is unaware of krill oil compositions having ether phospholipid concentrations as low as that reported by Fricke 1986. Ex. 1090, 108:12–23.

Accordingly, we find that an ordinarily skilled artisan would not have relied on the ether phospholipid levels reported by Fricke 1986 in view of the limitations of method of ether phospholipid quantification employed by

¹⁴ Burri et al., *Fingerprinting Krill Oil by P, H and C NMR Spectroscopies*, 93 J. Am. Oil Chem. Soc. 1037–1049 (2016) (Ex. 1079) (listing Dr. Hoem as a coauthor).

Fricke 1986, the related testimony of Dr. Tallon, and the admissions by Dr. Hoem. Neither do we find Patent Owner's contentions concerning the alleged error in Dr. Tallon's calculations—submitted in a separate case—persuasive to establish error in Petitioner's arguments in this case, as our decision does not rely upon those calculations.

We have also considered the various factors identified by Patent Owner as potentially altering the lipid content of the krill oil, such as the krill species and subtype used; the geographic region it is harvested from; the time of year harvested; as well as the harvesting, pre-processing, and extraction techniques used (PO Resp. 20–21), but we are not persuaded that these factors are “unpredictable,” or that their effects “must be determine[d] empirically” (*id.*). We are likewise unconvinced by Patent Owner's contention that “Catchpole does not provide a reproducible method for obtaining its disclosed lipid extract as Catchpole does not disclose a source for it material or how that material was collected, processed and handled (*id.* at 21).

The factors cited by Patent Owner are not critical to the production of the claimed krill oil. Independent claims 1 and 11 do not include any requirements concerning the source of the krill. Moreover, those claims require only that the krill is treated to denature lipases and phospholipases, and that krill oil is extracted with a polar solvent; claims 1 and 11 do not otherwise address how the krill is collected, processed or handled. In addition, the examples provided in the specification of the '877 patent suggest that an ordinarily skilled artisan would have been able to reproduce a krill extract without such information. Example 8 of the '877 patent

presents, in Table 22, the phospholipid profiles of the krill oil extracted from krill meal “according to the method described in example 7.” Ex. 1001, 31:46–47. Example 7 states that “[k]rill lipids were extracted from krill meal (a food grade powder) using supercritical fluid extraction.” *Id.* at 31:15–16. Notably, however, Example 7 of the ’877 patent does not specify the source of the krill meal. *Compare* 31:12–40 *with id.* at 20:3–4 (specifying that “krill meal obtained in example 1 was . . . subjected to a superfluid critical fluid extraction method”). Thus, here, we consider Example 8 of the ’877 patent to suggest that an ordinarily skilled artisan would have recognized that information regarding krill source is not critical to the production of krill oil, and would have understood how to obtain a krill extract having the properties disclosed despite lacking that information. Furthermore, we note that Patent Owner does not point us to any portion of the ’877 patent that discusses the allegedly unpredictable factors, nor can we find any such discussion, and none of those factors is included in the challenged claims.

Moreover, with particular regard to Catchpole, we find credible Dr. Tallon’s testimony that he would expect that the starting material used by Catchpole was freeze-dried *E. superba*. Ex. 2008, 112:6–15. That testimony is consistent with prior art disclosures that *E. superba* was the predominant krill species harvested in commercial catches (Ex. 1032, 3¹⁵), and had the “greatest potential for commercial utili[z]ation” (Ex. 1035 ¶ 5).

¹⁵ Grantham, *The Utilization of Krill*, (Southern Ocean Fisheries Survey Programme) (1977) (Ex. 1032).

It is also consistent with the '877 patent itself, which explains that “Antarctic krill (*Euphausia superba*) can be found in large quantities, ranging from 300–500 million metric tons of biomass” in the Southern Ocean, off the coast of Antarctica. Ex. 1001, 1:24–25.

In addition, we credit Dr. Tallon’s testimony that the factors that influence the lipid makeup of an extract “are finite and predictable, and that the specified krill oil compositions can be obtained without undue experimentation.” Ex. 1086 ¶ 86. For example, Dr. Tallon identifies several prior art studies that indicate that the lipid composition of *E. superba* falls within a predictable range, and that the range can be further categorized into particular geographical areas that each contain stations (i.e., sub-regions) with similar concentrations of different lipid components. Ex. 1086 ¶¶ 87–91 (citing Ex. 1007; Ex. 1032; Ex. 1084). In view of the depth of information available concerning krill composition, and the high level of skill in the art, we also credit Dr. Tallon’s testimony that it would have been a simple matter for an ordinarily skilled artisan “to measure the composition of the krill captured, and, if necessary, to modify either the region or season where the krill is harvested, or to modify the processing methods as described below, to give different known krill oil extract compositions” (Ex. 1086 ¶ 92), e.g., to obtain the ether phospholipid levels disclosed by Catchpole.

With regard to the harvesting, storage, and preprocessing of krill, we credit Dr. Tallon’s testimony, based on his review and discussion of several prior art references, that an ordinarily skilled artisan would have “had motivation to denature krill to reduce degradation including lipid hydrolysis,

and could draw on an extensive body of established industrial knowledge of methods and parameters that could be used to produce a stable product with known lipid compositions that were minimally impacted by the harvesting and pre-processing.” Ex. 1086 ¶ 100; *see also id.* ¶¶ 93–101 (characterizing the literature regarding krill harvesting, and explaining how an ordinarily skilled artisan would have understood that literature).

As for extraction, we again credit Dr. Tallon’s analysis of the literature (Ex. 1086 ¶¶ 102–109), and his testimony that an ordinarily skilled artisan would have had confidence in using known techniques, “in combination where required, to produce extracts from krill that have known compositions” (*id.* ¶ 106). We additionally credit Dr. Tallon’s testimony that, with regard to the specific combination of Catchpole and Fricke 1984, which use different extraction methods, an ordinarily skilled artisan would have known “from Catchpole and established industry knowledge that the supercritical fluid extraction of Catchpole would produce certain fractions of the lipid composition and could be adjusted in known ways, for example to produce a more complete total phospholipid fraction.” *Id.* ¶ 108. Such an artisan also would have known

that the extraction of Fricke [1984] used a quantitative method for analysis and represents the total distribution of lipid content and composition of *Euphausia superba* krill. In particular, Fricke [1984] explicitly disclosed both the polar and neutral lipid components, as well as the fatty acid composition of lipid classes, sterols, etc.

Id.

Lastly, we credit Dr. Tallon’s testimony that an ordinarily skilled artisan would have had a reasonable expectation of success in combining

Breivik, Catchpole, and Fricke 1984 to arrive at the claimed invention because the lipid components described in the claims of the '877 patent “are the natural lipid components in the krill oil that can be extracted using any of a number of suitable solvents,” and that the relative proportions of those lipid components could be “varied in predictable ways . . . to selectively extract specific groups of lipid components based on their different solubility, and by blending these selective extracts in known and predictable ways to produce a desired krill oil composition” using methods and solvents that would have been well-known by a relevant skilled artisan. Ex. 1006 ¶ 212.

Based on the foregoing, therefore, we determine that Petitioner has established by a preponderance of the evidence that claims 1–3, 6, 8, 9, 11, 12, 15, 17 and 18 of the '877 patent are unpatentable over the combination of Breivik, Catchpole and Fricke 1984.

*E. Obviousness Based on
Breivik, Catchpole, Fricke 1984, and Bottino*

Petitioner asserts that dependent claims 4, 5, 13, and 14 are unpatentable under § 103(a) as obvious in view of Breivik, Catchpole, Fricke 1984, and Bottino. Pet. 51–59. Claims 4 and 13 depend, respectively, from claims 1 and 11, and further required that the recited “krill oil comprises from about 20% to about 35% omega-3 fatty acids as a percentage of total fatty acids in said krill oil.” Ex. 1001, 35:7–9, 36:10–12. Claims 5 and 14 depend, respectively, from claims 4 and 13, and additionally require that “from about 70% to about 95% of the omega-3 fatty

acids are attached to said total phospholipids.” *Id.* at 35:10–12, 36:13–15. Petitioner relies on Bottino and Fricke 1984 as teaching these claim requirements, and asserts that an ordinarily skilled artisan would have had reason for, and a reasonable expectation of success in, combining Breivik, Catchpole, Fricke 1984, and Bottino. Pet. 51–59.

Patent Owner does not challenge Petitioner’s assertions concerning Fricke 1984 or Bottino’s disclosures, or the addition of Bottino to the combination of Breivik, Catchpole, and Fricke 1984. Rather, Patent Owner argues that “[t]he addition of Bottino to the combination does not address the defects noted for the base combination of Breivik, Catchpole and Fricke 1984.” PO Resp. 22. According to Patent Owner, for the same reasons discussed above with regard to the combination of Breivik, Catchpole, and Fricke 1984, an ordinarily skilled artisan “would not have combined Breivik, Catchpole, Fricke 1984 and Bottino because there is no scientific basis to combine ranges for lipid components of oils produced by different methods and from different starting materials to produce a single defined oil.” *Id.* Patent Owner additionally reasons that because Bottino uses the same chloroform-methanol extraction as Fricke 1984, “Bottino’s oil would most likely contain similar levels of ether phospholipids as the Fricke 1984 and 1986 oil which is much lower than the ranges specified in the claims.” *Id.* (citing Ex. 2001 ¶ 43).

For the reasons set forth above with regard to the asserted grounds of unpatentability over Breivik, Catchpole, and Fricke 1984, we do not find Patent Owner’s arguments persuasive. As previously discussed, we find that an ordinarily skilled artisan would have had reason for, and a reasonable

expectation of success in, combining Breivik, Catchpole, and Fricke 1984. In making this finding, we note that to the extent Patent Owner contends that Bottino's oil would contain ether phospholipid levels similar to those reported in Fricke 1986, Patent Owner has not identified record evidence or argument sufficient to support that contention. Indeed, Dr. Hoem does not identify support for his testimony that "the oil in Bottino was also made by chloroform-methanol extraction and thus combination of Bottino with Breivik, Catchpole and Fricke is not appropriate for the same reasons as noted for the base combination" (Ex. 2001 ¶ 43), which Patent Owner points to as the sole support for its argument concerning the composition of Bottino's oil. PO Resp. 22. Furthermore, Dr. Hoem's testimony is not addressed to the ether phospholipid content of Bottino, and, therefore, is insufficient, without more, to support argument that the krill oil of Bottino has ether phospholipid levels similar to those reported in Fricke 1986.

Additionally, an ordinarily skilled artisan would have had a reason to include Bottino in the combination because Bottino discloses the levels of fatty acids, and in particular, the levels of omega-3 fatty acids, present in krill oil. Pet. 51–54; Ex. 1007, Table 1, Table 3. Furthermore, we have reviewed Petitioner's evidence and arguments, which we adopt as our own, and determine that Petitioner has established that claims 4, 5, 13, and 14 are rendered obvious by the combination of Breivik, Catchpole, Fricke 1984, and Bottino. Pet. 51–59.

Accordingly, we determine that Petitioner has established by a preponderance of the evidence that claims 4, 5, 13, and 14 of the '877 patent

are unpatentable over the combination of Breivik, Catchpole, Fricke 1984, and Bottino.

*F. Obviousness Based on
Breivik, Catchpole, Fricke 1984, and Sampalis I*

Petitioner asserts that claims 7 and 16 are unpatentable under § 103(a) in view of Breivik, Catchpole, Fricke 1984, and Sampalis I. Pet. 59–60. Patent Owner disagrees. PO Resp. 22–26.

*1. Teachings of Breivik, Catchpole,
Fricke 1984, and Sampalis I*

Claims 7 and 16 depend, respectively, from claims 1 and 11, and further require “encapsulating said krill oil.” Ex. 1001, 35:15–16, 36:18–19. Petitioner contends that Sampalis I discloses this claim step. In particular, Petitioner asserts that Sampalis I teaches that the commercial NKO product administered is extracted from *E. superba*, and that *E. superba* “is rich in phospholipids and triglycerides carrying long chain omega-3 polyunsaturated fatty acids, such as EPA and DHA.” Pet. 59–60 (citing Ex. 1012, 4). Petitioner also contends that Sampalis I teaches that a study of patients who were asked to take two 1-gram soft gels of either NKO or omega-3 18:12 fish oil” once daily “determined that NKO significantly reduces the physical and emotional symptoms of premenstrual syndrome and was significantly more effective for managing PMS symptoms than fish oil.” *Id.* (citing Ex. 1012, 4). Petitioner relies on the previously described teachings of Breivik, Catchpole, and Fricke 1984 as disclosing the elements of claims 1 and 11, from which claims 7 and 16 depend. *Id.* at 59.

Having reviewed the cited evidence, and the record as a whole, we find that Petitioner has accurately described the above-stated teachings of Breivik, Catchpole, Fricke 1984, and Sampalis I, which we adopt as our own. See Pet. 31–44, 59–60. Indeed, Patent Owner does not challenge Petitioner’s assertion that Breivik, Catchpole, Fricke 1984 and/or Sampalis I discloses each element of challenged claims 7 and 16. Instead, the parties’ dispute centers upon whether an ordinarily skilled artisan would have had reason to combine Breivik, Catchpole, Fricke 1984, and Sampalis I. Thus, our following analysis focuses on that issue.

*2. Rationale to Combine
and Reasonable Expectation of Success*

Petitioner asserts that “Sampalis I discloses a convenient method of administering an encapsulated krill oil to a person in need thereof in the form of a soft gel capsule.” Pet. 60. According to Petitioner, an ordinarily skilled artisan would have incorporated the teachings of Sampalis I into the previously described combination of Breivik, Catchpole, and Fricke 1984 in order to administer, in a convenient dosage form, to a person in need thereof, the krill oil obtained according to the method of Breivik, Catchpole, and Fricke 1984. *Id.* (citing Ex. 1006 ¶¶ 28–32, 273).

Patent Owner first asserts that “combination with Sampalis I does not address the defects noted above respect to the base combination of Breivik, Catchpole and Fricke [1984] and thus the combination is not appropriate for the same reasons as noted for the base combination.” PO Resp. 23. Specifically, Patent Owner reiterates its contention that “there is no scientific basis to combine ranges for lipid components of oils produced by different

methods and from different starting materials to produce a single defined oil.” *Id.*

Patent Owner additionally argues that an ordinarily skilled artisan would not have had reason to use Catchpole’s high ether phospholipid containing krill extract to treat conditions associated with inflammation, such as PMS, as taught by Sampalis I, “because the prior art teaches that krill ether phospholipids are precursors of PAF-like compounds that trigger inflammation..” PO Resp. 23. According to Patent Owner, because of the “known PAF-like activity of compounds derived from peroxidation of krill ether phospholipids,” an ordinarily skilled artisan “faced with a choice of what krill oil to use . . . would have chosen to use a krill oil such as disclosed in Fricke 1984 and 1986 that had minimal levels of ether lipids, i.e., 10-fold lower than the krill oil specified in the claims.” *Id.* 24. Patent Owner also argues that “there is no indication in Catchpole that the fraction containing 4.8% ether phospholipids should be provided in a capsule or otherwise used as a dietary supplement. *Id.* at 25 (citing Ex. 2001 ¶ 47). Patent Owner further asserts that Petitioner’s declarant, “Dr. Tallon apparently did not consider evidence that teaches away from the claimed invention and was unaware of the concept and its relation to analysis of obviousness.” *Id.* at 24–25.

On Reply, Petitioner asserts that, for the same reasons discussed above with regard to the combination of Breivik, Catchpole, and Fricke 1984, an ordinarily skilled artisan “would have been fully aware that, depending on the starting krill material, conventional extraction techniques

could be routinely modified, resulting in predictable changes to the composition of the resulting krill oil.” Reply 16.

In response to Patent Owner’s PAF arguments, Petitioner asserts that PAF differs structurally from the ether phospholipids found in krill oil, in that the latter possess much longer acyl chains, ranging from 14–25 carbon atoms, which do not exhibit PAF signaling activity. Reply 18–19 (citing Ex. 1086 ¶¶ 20, 22–24). Rather, contends Petitioner, “PAF activity only exists if the acyl group is substantially shorter, in the range of 1–4 carbon atoms.” Reply 19; *see also id.* at 19–20 (asserting that Prescott teaches that ether phospholipids with acyl groups longer than 4 carbon atoms would not exhibit PAF activity) (citing Ex. 2003, 13; Ex. 1086 ¶¶ 20, 22). Petitioner also argues that Tanaka, Prescott, and Zimmerman address only “artificially oxidized lipid products that may have PAF-like behavior, and draw[] no connection between the oral administration of ether phospholipids and in-vivo signaling behavior.” Reply 20. Petitioner further asserts that an ordinarily skilled artisan would have recognized that PAF-like lipids have lower activity than PAF itself because PAF-like lipids only mimic the functionality of PAF. Reply 21 (citing Ex. 1086 ¶¶ 25, 29; Ex. 2003, 13).

In addition, Petitioner contends that because the PAF signaling system is tightly controlled and subject to rapid degradation, “oral administration of ether phospholipids does not contribute to the process described by Prescott.” Reply 22 (citing Ex. 1086 ¶ 21). Petitioner similarly asserts that “PAF-like lipids are rapidly degraded by the body’s natural mechanisms.” *Id.* (citing Ex. 1086 ¶ 31).

According to Petitioner,

[t]he “PAF publications” relied upon by Patent Owner only describe artificially oxidized lipid products that may exhibit some PAF-like behavior, but draw no connection between oral administration of ether phospholipids and in-vivo signaling behavior. (Tallon Reply (Exhibit 1086), ¶¶ 26-27, 30). This, combined with the low activity of the degradation products compared with true PAF, their low concentration, the proliferation of different degradation products of which the majority have no PAF-like activity, and the body’s natural metabolization to remove them from the body, would not have discouraged a POSITA from encapsulating an effective amount of a krill oil composition containing from about 3% to 15% ether phospholipids. (Tallon Reply (Exhibit 1086), ¶ 32).

Reply 22.

Petitioner also asserts that an ordinarily skilled artisan at the time of invention of the ’877 patent would have recognized that “krill oil compositions with ‘substantial’ levels of ether phospholipid[s] [], including then-existing commercial krill oil products, exhibited a variety of health benefits.” Reply 23. In this vein, Petitioner contends that it was known in the art that ether phospholipids confer health benefits by enhancing delivery of DHA to the brain. *Id.* (citing Ex. 1086 ¶¶ 33–34, 1072, 11, 18–19). In addition, Petitioner asserts that krill oils having a high phospholipid content were known to provide health benefits, and were recognized as useful in medical products, health food, and human nutrition. *Id.* (citing Ex. 1006

¶¶ 95–96; Ex. 1086 ¶¶ 35, 45–49, 61; Ex. 1009, 24; Ex. 1035, 2–3; Ex. 1037, 1:14–19;¹⁶ Ex. 1036, 1:9–14¹⁷).

Petitioner likewise argues that, as evidenced by the prior art, as well as analysis of the '877 patent and its file history, prior art krill oil products, such as NKO, were recognized as having “substantial or high” levels of ether phospholipids, based on Dr. Hoem’s conception of those terms. Reply 24–30. According to Petitioner, an ordinarily skilled artisan, thus, “would have readily known that ‘high levels’ of ether phospholipids were actually present in commercial krill oil products and not harmful.” Reply 29 (citing Ex. 1086 ¶ 59).

Based on our review of the record as a whole, we determine that a preponderance of the evidence supports Petitioner’s contention that an ordinarily skilled artisan would have had reason for, and a reasonable expectation of success in, combining Breivik, Catchpole, Fricke 1984, and Sampalis I to arrive at the claimed invention. We address Patent Owner’s arguments below.

Central to Patent Owner’s position is the assertion that krill ether phospholipids “can cause inflammation.” PO Resp. 24 (“A POSITA would not then seek to encapsulate a krill oil with from 3–10% w/w of compounds that can cause inflammation.”). Neither Patent Owner, nor its declarant, Dr. Hoem, however, provides evidence or argument sufficient to support that

¹⁶ Breivik, WO 2008/060163 A1, filed Nov. 15, 2007 (Ex. 1037).

¹⁷ Breivik, US Provisional Patent Application No. 60/859,289, filed Nov. 16, 2006 (Ex. 1036).

assertion. Rather, the record reveals that the ether phospholipids of Catchpole are not the same compounds as PAF or PAF-like lipids, and Patent Owner has not adduced evidence or set forth argument adequate to support its contention that the ether phospholipids of Catchpole exhibit PAF-like activity. In addition, the prior art fails to draw any connection between the dietary intake of krill ether phospholipids and the production of PAF or PAF-like lipids or activity such as inflammation.

PAF and the PAF-like compounds Patent Owner characterizes as exhibiting pro-inflammatory activity are structurally and functionally distinct from the ether phospholipids present in Catchpole's krill extract, which do not exhibit PAF-like behavior. As Prescott, one of the references relied upon by Patent Owner as teaching away from the combination of Breivik, Catchpole, Fricke 1984, and Sampalis I, explains, PAF-like activity typically exists only where the acyl group of the phospholipid is in the range of 1–4 carbon atoms:

The PAF receptor recognizes the *sn*-1 ether bond of PAF, its short *sn*-2 acetyl residue, and the choline head group; alteration of any of these structures greatly decreases signaling through the PAF receptor. Extension of the *sn*-2 acetyl residue by one methylene is without consequence, but extension by two methylenes decreases activity by a factor of 10- to 100-fold, depending on the assay. Extension beyond this results in the loss of signaling through the PAF receptor.

Ex. 2003, 13 (citations omitted). In contrast, as evidenced by the '877 patent, and Tanaka, another of the references relied upon to support Patent Owner's teaching away argument, the natural range of acyl groups in krill oil AAPC is from 14 to 24 carbon atoms. Ex. 1001, Table 23;

Ex. 1014, 2. Accordingly, we credit Dr. Tallon's testimony that "the natural AAPC present in krill has fatty acids groups (C14–C24) well outside the range that have PAF-like activity (C1–C4)." Ex. 1086 ¶ 25.

Moreover, at best, Prescott, Tanaka, and Zimmerman, the three teaching away references cited by Patent Owner, suggest the possible formation of peroxidation products from dietary ether phospholipids under artificial conditions, and disclose that certain of those artificially generated products are similar enough to PAF to trigger the same inflammatory effects. Critically, however, none of these references draws a link between the artificial oxidation of natural ether phospholipids present in krill, and the *in vivo* signaling behavior of krill ether phospholipids.

For example, Prescott reports that although the artificial "[o]xidation of complex lipids in reduced systems has defined potential oxidation pathways and products, . . . whether such oxidizing conditions exist in vivo is problematic, given the unstable nature of the reactive intermediates and the potential of metabolism of the oxidation products." Ex. 2003, 14.

Similarly, Tanaka, which "investigated the PAF-like lipids formed during peroxidation of PCs from hen egg yolk, salmon roe, sea urchin eggs, and krill in an [*in vitro*] FeSO₄/EDTA/ascorbate system" (Ex. 1014, 1), recognizes that "the occurrence of PAF-like lipids in some stored foods is still speculative and requires further investigation" (*id.* at 5). In addition, as Dr. Tallon observes, "[t]he results reported by Tanaka [] apply equally to artificial degradation products of ether phospholipids from general food products such as hen egg yolk, which were and continue to be widely and safely consumed by humans" (Ex. 1086 ¶ 28).

Zimmerman, a review article, includes a discussion of the possible production of oxidized phospholipids that exhibit PAF-like activity, but like Prescott and Tanaka, discloses only the artificial generation of such products, and does not attempt to link dietary intake of natural ether phospholipids and the activity of the potential degradation products described. Ex. 2004, 4–5.

In addition, Dr. Hoem, Patent Owner’s declarant could not recall having seen any indication in the literature that ether phospholipids can be degraded into PAF-like molecules through ingestion. Ex. 1090, 35:4–9.

Furthermore, the record suggests that an ordinarily skilled artisan would not have been concerned about PAF-like activity arising from dietary ether phospholipid supplementation because the quantity of PAF-like lipids produced even through the artificial oxidation processes described in the prior art is quite small. For example, Prescott discloses that only “[s]ome of the many phospholipid oxidation products contain the same features of PAF” (Ex. 2003, 11), and highlights the “unstable nature of the reactive intermediates and the potential of metabolism of the oxidation products” (*id.* at 14), which may lead to the degradation of any PAF-like lipids generated *in vivo*. In addition, Tanaka teaches that the proportion of the artificially produced ether phospholipid oxidation products represents a small proportion of the ether phospholipid starting material. Ex. 1014, 5 (“[T]he yields of 1-*O*-hexadecyl-2-propionyl-GPC and 1-*O*-hexadecyl-2-butyryl-GPC were 0.0035% and 0.0049% (or 0.0076%), respectively, of the starting krill PC.”).

We also observe that the commercial realities at the time of invention of the '877 patent do not support Patent Owner's contention that an ordinarily skilled artisan would have sought to avoid using krill oil extracts having "high" ether phospholipid levels as a dietary supplement. Dr. Hoem testified at deposition that "high" or "substantial" levels of ether phospholipids were essentially any levels that could be quantified. Ex. 1090, 58:10–20; *see also id.* at 54:16–55:10 (characterizing "substantial levels" as "[d]ifferent from trace levels," i.e., levels that could be quantified). Notably, Dr. Hoem also testified that commercially available NKO, which was on sale prior to the invention of the '877 patent (Ex. 1090, 61:9–12), and which the '877 patent identifies as including 2.46% ether phospholipids (Ex. 1001, Table 22), had a "substantial or high" level of ether phospholipids. Ex. 1090, 59:2–61:12. Nevertheless, the record is devoid of evidence suggesting any concern relating to potential harm from the ether phospholipids present in NKO, or any other commercially available prior art krill oil extract. To the contrary, the evidence of record demonstrates that NKO was generally recognized as safe (*see* Ex. 1075; Ex. 1091). Indeed, Patent Owner itself relied on the prior art clinical studies of NKO reported by Sampalis I to establish that its own krill oil product was safe. Ex. 1089, 19; Ex. 1090, 52:10–16. Furthermore, although the '877 patent highlights the potential of the disclosed krill oil to reduce inflammation (*see, e.g.,* Ex. 1001, Abstract), it nowhere mentions that such result is unexpected or different from what was achieved by prior art krill oil products. *Cf. id.* at 11:34–41 ("The krill oils of the present invention also have unexpected and superior properties as compared to previously available krill oils. [They

have] been demonstrated to reduce blood LDL cholesterol levels, improve DHA transfer to the brain as well as reduce lipid accumulation in the liver and muscle while the previously described krill oil compositions do not have such [] properties.”).

Accordingly, we are not persuaded that an ordinarily skilled artisan would have expected krill oil having the ether phospholipid content reported by Catchpole to cause inflammation as Patent Owner contends. Nor do we agree that Prescott, Tanaka, and/or Zimmerman teach away from the combination of Breivik, Catchpole, Fricke 1984, and Sampalis I.

Turning to Patent Owner’s contention that “there is no indication in Catchpole that the fraction containing 4.8% ether phospholipids should be provided in an effective amount in a capsule or otherwise used as a dietary supplement” (PO Resp. 25), we find that an ordinarily skilled artisan confronted with Catchpole would have had reason to use the ether phospholipid-rich extract reported in Table 16 in an encapsulated dietary supplement. As explained previously, Catchpole identifies phospholipids as conferring myriad health benefits (Ex. 1009, 1:29–2:6), states that an object of the invention disclosed is “to provide a process for producing a product that contains desirable levels of particular phospholipids,” (*id.* at 3:27–29), and highlights the enrichment of AAPC in the “concentrated phospholipids-rich extract” obtained using the extraction process disclosed (*id.* at 24:1–16). An ordinarily skilled artisan, therefore, would have sought to use Catchpole’s “concentrated phospholipids-rich” extract as a dietary supplement in order to reap the known benefits of phospholipids. In contrast, for the reasons stated above, an ordinarily skilled artisan at the time

of the invention would not have recognized Fricke 1986 as accurately disclosing the ether phospholipid content of krill oil, and, thus, would not have relied on the values reported by Fricke 1986 in formulating a dietary supplement.

Lastly, we credit Dr. Tallon's testimony that "it would have been a simple matter" for an ordinarily skilled artisan to combine Breivik, Catchpole, Fricke 1984, and Sampalis I to arrive at the claimed invention. As Dr. Tallon explains:

Breivik discloses processing freshly captured krill on board the ship by heat treating to produce a denatured krill meal product. Catchpole and Breivik discloses methods of extracting lipids from krill, and further disclose the fractionation of extracts of such lipids. Catchpole and Breivik further disclose that phospholipids have been implicated in conferring a number of health benefits. Fricke [1984] indicates there were a number of prior publications that investigated krill and provided actual fatty acid data. Thus, a POSITA would have considered references, such as Fricke [1984] and Catchpole, to determine the components naturally found in the krill processed and denatured in Breivik and would have also looked to Sampalis I as describing the convenient method of administering krill oil in the form of encapsulated krill oil (i.e., in soft gel capsules) for use in addressing inflammatory conditions such as PMS.

Ex. 1086 ¶ 273.

Based on the foregoing, therefore, we determine that Petitioner has established by a preponderance of the evidence that claims 1–4, 9, and 10 of the '877 patent are unpatentable over the combination of Breivik, Catchpole, Fricke 1984, and Sampalis I.

*G. Obviousness Based on
Breivik, Catchpole, Fricke 1984, and Sampalis II*

Petitioner asserts that dependent claims 10 and 19 are unpatentable under § 103(a) as obvious in view of Breivik, Catchpole, Fricke 1984, and Sampalis II. Pet. 61–62. Claims 10 and 19 depend, respectively, from claims 1 and 11, and further require that the species of krill used in the recited method is *Euphausia pacifica*. Ex. 1001, 35:21–22, 36:24–25. Petitioner relies on Sampalis II as teaching this claim requirement, and asserts that an ordinarily skilled artisan would have had reason for, and a reasonable expectation of success in, combining Breivik, Catchpole, Fricke 1984, and Sampalis II. Pet. 61–62.

Patent Owner does not challenge Petitioner’s assertions concerning the disclosures of Sampalis II, or the addition of Sampalis II to the combination of Breivik, Catchpole, and Fricke 1984. Rather, Patent Owner argues that “[t]he addition of Sampalis II to the combination does not address the defects noted for the base combination of Breivik, Catchpole and Fricke 1984.” PO Resp. 26–27. Patent Owner further contends that an ordinarily skilled artisan “would not have combined Breivik, Catchpole, Fricke 1984 and Sampalis II because there is no scientific basis to combine ranges for lipid components of oils produced by different methods and from different starting materials to produce a single defined oil.” *Id.* at 27.

For the reasons set forth above with regard to the asserted grounds of unpatentability over Breivik, Catchpole, and Fricke 1984, however, we do not find Patent Owner’s arguments persuasive. As previously discussed, we find that an ordinarily skilled artisan would have had reason for, and a

reasonable expectation of success in, combining Breivik, Catchpole, and Fricke 1984. Additionally, an ordinarily skilled artisan would have had reason to include Sampalis II in the combination because Breivik, Catchpole, and Sampalis II each disclose that phospholipids have been implicated in conferring numerous health benefits (*see, e.g.*, Ex. 1009, 1:29–2:2; Ex. 1035 ¶¶ 2–3; Ex. 1013, 3:4–12, 27:8–16), and Sampalis II further teaches that krill, including *E. pacifica*, is a useful starting material for obtaining a phospholipid rich extract (Ex. 1013, 25:2–10). Pet. 62 (citing ¶¶ 28–32, 277). Furthermore, we have reviewed Petitioner’s evidence and arguments, which we adopt as our own, and determine that Petitioner has established that claims 10 and 19 are rendered obvious by the combination of Breivik, Catchpole, Fricke 1984, and Sampalis II.

Accordingly, we determine that Petitioner has established by a preponderance of the evidence that claims 10 and 19 of the ’877 patent are unpatentable over the combination of Breivik, Catchpole, Fricke 1984, and Sampalis II.

III. CONCLUSION

For the foregoing reasons, we conclude that Petitioner has shown by a preponderance of the evidence that claims 1–19 of the ’877 patent are unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–3, 6, 8, 9, 11, 12, 15, 17, and 18 of the '877 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Breivik, Catchpole, and Fricke 1984;

FURTHER ORDERED that claims 4, 5, 13, and 14 of the '877 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Breivik, Catchpole, Fricke 1984, and Bottino;

FURTHER ORDERED that claims 7 and 16 of the '877 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Breivik, Catchpole, Fricke 1984, and Sampalis I;

FURTHER ORDERED that claims 10 and 19 of the '877 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Breivik, Catchpole, Fricke 1984, and Sampalis II; and

FURTHER ORDERED that because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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