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Filed: 2 December 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Mirexus Biotechnologies, Inc.
(Inventors: Anton Korenevski, Erzsebet Papp-Szabo,
John Robert Dutcher, and Oleg Stukalov)

Junior Party
(Patent 9,737,608),

v.
Purdue Research Foundation
(Inventor: Yuan Yao)

Senior Party
(Patent Application 14/130,412).

Patent Interference No. 106,101 (DK)

Judgment
37 C.F.R. § 41.127(a)

Before SALLY GARDNER LANE, JAMES T. MOORE, and DEBORAH KATZ, *Administrative Patent Judges*.

KATZ, *Administrative Patent Judge.*

In light of the determination that the parties' claims do not interfere (*see* Decision on Motions, Paper 211), we enter judgment of no interference-in-fact, which neither cancels nor finally refuses either parties' claims.

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Patent Interference No. 106,101 (DK)

Decision on Motions
37 C.F.R. § 41.125(a)

Before SALLY GARDNER LANE, JAMES T. MOORE, and DEBORAH KATZ, *Administrative Patent Judges*.

KATZ, *Administrative Patent Judge.*

Introduction

Junior Party Mirexus Biotechnologies, Inc. ("Mirexus") is involved in this interference based on its patent 9,737,608 ("the '608 patent"), which issued from an application filed 26 October 2015. (*See* Declaration, Paper 1, 3.) Claims 17–29 of the '608 patent were designated as corresponding to Count 1 of the interference, whereas claims 1–16 and 30 were not. (*See id.* at 4.) Mirexus was accorded benefit of the filing date, 25 April 2014, of its prior international application when the interference was declared. (*See id.* at 5.)

Senior Party Purdue Research Foundation ("PRF") is involved based on its application 14/130,412 ("the '412 application"), which was filed 3 March 2014. (*See id.* at 3.) Claims 1–3, 46, and 48–50, all of the pending claims, of the '412 application were designated as corresponding to Count 1 of the interference. (*See id.* at 4.) PRF was accorded benefit of the filing date, 2 August 2012, of its prior international application when the interference was declared. (*See id.* at 5.)

Both parties' claims, and thus Count 1, are directed to methods of preparing phytoglycogen – a plant polysaccharide. Like glycogen, a similar polysaccharide found in animals, phytoglycogen is an energy storage molecule. (*See* '608 patent, Ex. 2009, 1:18–27; '412 appl.[1], Ex. 1002, 1:9.) The parties report that various methods of isolating glycogen from plant material were known in the art before their inventions. (*See* '608 patent, Ex. 2009, 1:43–47; '412 appl., Ex. 1002, 1:19–

[1] PRF presents International Patent Application Publication WO 2013/019977, Exhibit 1002, for the '412 application, asserting that the international application is identical to the '412 application. (*See* PRF Exhibit List, Paper 197, description of Exhibit 1002.)

24.) In general, the parties' currently involved claims recite methods wherein plant material is contacted with water, the aqueous phase is separated from the solids and subjected to filtration to obtain particles that are 300 kDa or larger. (*See* Mirexus Clean Copy of Claims, Paper 7; PRF's Clean Copy of Claims, Paper 6.)

The parties are before us in the preliminary motions phase of the interference. Mirexus filed three motions.[2] In two of these motions, Mirexus argues that the interference should be terminated. One motion argues that the Office does not have jurisdiction over the '608 patent in an interference because the '608 patent is subject to the provisions of the Leahy-Smith America Invents Act ("AIA"). (*See* Mirexus Motion 2, Paper 174.) The other argues that the subject matter of the parties' claims do not interfere, as defined in 37 C.F.R. § 41.203(a). (*See* Mirexus Motion 3, Paper 175.) In addition to these motions, Mirexus filed a motion arguing that PRF's claims are not patentable under 35 U.S.C. § 112, first paragraph, for lack of a sufficient written description. (*See* Mirexus Motion 4, Paper 176.)

PRF filed two motions.[3] In Motion 1, PRF argues that Mirexus claims 1–16 and 30 should be designated as corresponding to the count. (PRF Motion 1,

[2] Mirexus was authorized, but chose not to file a motion arguing that it should be accorded the benefit of priority of the filing date of its provisional application 61/816,686 as a constructive reduction to practice of the count. (Mirexus Notice Regarding Motion 5, Paper 177.)

[3] PFR was authorized to file a motion to add one claim, copied from Mirexus's involved '608 patent claims 1–16 and 30, to its involved '412 application and to include one additional count in the interference. (*See* Order Authorizing Motions and Setting Times, Paper 18, 6:3–6.) PRF did not file this motion.

Paper 147.) PRF also filed a motion to be accorded benefit of the filing date (2 August 2011) of its provisional application 61/514,399 as a constructive reduction to practice of the count. (*See* PRF Motion 3, Paper 146.)

To support its arguments about the subject matter of the interference, Mirexus presents the declaration of Dr. Rickey Yada (Ex. 2001). Dr. Yada testifies that he is Professor and Dean, Faculty of Land and Food Systems at the University of British Columbia and has been engaged in food science research for 35 years. (*See* Declaration of Dr. Rickey Yada ("Yada Decl."), Ex. 2001, ¶ 9.) Dr. Yada testifies further that he has conducted research in food science relating to the postharvest quality of fruits and vegetables and has authored more than 50 original peer-reviewed publications in that field, as well as reviews, books and book chapters on these and related subjects. (*See id.* at ¶ 15.) PRF does not dispute Dr. Yada's qualifications. We find Dr. Yada to be qualified to provide opinion testimony on the subject matter of this interference.

PRF does not present the testimony of a witness who can provide opinions on the subject matter of the interference.

We first turn to Mirexus's motion to terminate the proceeding because the parties' claims do not interfere.[4] *See* 37 C.F.R. § 41.125(a) ("The Board may take up motions for decisions in any order, may grant, deny, or dismiss any motion, and may take such other action appropriate to secure the just, speedy, and inexpensive

[4] Both parties requested oral argument. (*See* Papers 208 and 209.) After review of the parties' briefs and evidence, oral argument was not considered to be necessary. Accordingly, as is our discretion, no oral argument was held. *See* 37 C.F.R. § 41.124(c)("If a request for oral argument is granted . . . .").

determination of the proceeding.") After reviewing Mirexus's arguments, PRF's arguments, and the evidence each presents in support, we grant Mirexus Motion 3. Because a determination of no interference-in-fact deprives the parties of standing in the proceeding, we terminate the procedding without deciding the parties' other motions. *See* 37 C.F.R. § 41.201 (including no interference-in-fact as a threshold issue, wherein "*[t]hreshold issue* means an issue that, if resolved in favor of the movant, would deprive the opponent of standing in the interference.").

Mirexus Motion 3

Under 37 C.F.R. § 41.203(a), "[a]n interference exists if the subject matter of a claim of one party would, if prior art, have anticipated or rendered obvious the subject matter of a claim of the opposing party and vice versa." Thus, we look to the elements of the parties' claims to determine if there is interference-in-fact between them. Mirexus argues that there is no interference because elements recited in Mirexus's claim 17 are not anticipated or rendered obvious by PRF's claims. (*See* Mirexus Motion 3, Paper 175.) PRF opposes this motion (*see* PRF Opp. 3, Paper 190) and Mirexus replied (*see* Mirexus Reply 3, Paper 201).

Mirexus claim 17 is representative and recites:

> A method of producing monodisperse phytoglycogen nanoparticles comprising:
>
> a. immersing disintegrated a phytoglycogen-containing plant material in water at a temperature between about 0 and about 50°C;
>
> b. subjecting the product of step (a.) to a solid-liquid separation to obtain an aqueous extract;
>
> c. passing the aqueous extract of step (b.) through a microfiltration material having a maximum average pore size of between about 0.05 and 0.15 μm; and

> d. subjecting the filtrate from step c. to ultrafiltration to remove impurities having a molecular weight of less than 300 kDa to obtain an aqueous composition comprising monodisperse phytoglycogen nanoparticle, having a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS).

(Mirexus Clean Copy of Claims, Paper 7.)

PRF claim 1 is representative and recites:

> A method for extracting soluble phytoglycogen from kernels or fractions of kernels of a maize mutant sugary-1 (su1) comprises:
> (1) contacting the kernels or fractions of kernels with water;
> (2) separating and removing solids from the combination of kernels or fractions of kernels and water to generate a water extract containing soluble phytoglycogen;
> (3) subjecting the water extract containing soluble phytoglycogen to tangential flow ultrafiltration to reduce saccharide impurities having molecular weight of 300,000 Daltons (Da) or less; and
> (4) collecting aqueous retentate fraction of ultrafiltration that comprises at least 90% purity (dry weight base) of soluble phytoglycogen components of molecular weight above 300,000 Da.

(PRF's Clean Copy of Claims, Paper 6 (indentations and spacing added).)

Mirexus argues that PRF's claims fail to teach or suggest a method for extracting phytoglycogen by, among other elements, passing an aqueous extract "through a microfiltration material having a maximum 3 average pore size of between about 0.05 and 0.15 μm." (Mirexus Motion 3, Paper 175, 12:1–4.) Mirexus argues further that the method recited in PRF's claims fails to obtain a "monodisperse phytoglycogen nanoparticle" that has "a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS)." (*Id.* at 12:4–6.)

A.

To evaluate Mirexus's arguments, we turn to the meaning of specific terms in its claim 17. In regard to the term "monodisperse," Dr. Yada testifies that a suspension of nanoparticles is considered to be "monodisperse when it contains particles of nearly the same size forming a narrow distribution about an average value." (Yada Decl., Ex. 2001, ¶ 45, citing to Ex. 2035.) Dr. Yada testifies further that "[a] polydisperse suspension of nanoparticles contains particles of different sizes, forming a broad distribution." (Yada Decl., Ex. 2001, ¶ 45.) Dr. Yada testifies that size distribution is important because it affects bulk properties, product performance, stability, and appearance. (*See id.*, citing Ex. 2060 (abstract: "These include average particle size/diameter and the polydispersity index (PDI), which is an indication of their quality with respect to the size distribution.") According to Dr. Yada, a person of ordinary skill in the art would consider many factors in evaluating the monodispersity of a sample, including: the component(s) of the particles, whether the sample is heterogeneous or homogeneous, the molecular weight range, the particle size range, the molecular weight or particle size histograms, and the standard deviation in the particle size or molecular weight. (Yada Decl., Ex. 2001, ¶ 46.)

The phrase, "polydispersity index" or "PDI," highlighted by Mirexus in its claim 17, characterizes phytoglycogen preparations. (*See* '608 patent, Ex. 2009, 5:20–27.) According to the '608 patent, there are two ways of calculating polydispersity. The first technique uses diameters of particles determined by dynamic light scattering ("DLS"). A PDI using DLS-determined particle diameters is defined as the square of the ratio of standard deviation ("σ") to mean

diameter ("d"), that is, PDI=$(\sigma/d)^2$. (*See id.* at 5:20–22.) The '608 patent explains that a monodisperse material has a PDI close to zero. (*See id.* at 5:27–29.)

Mirexus claim 17 recites polydispersity using this technique, wherein the method is "to obtain an aqueous composition comprising monodisperse phytoglycogen nanoparticle, having a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS)." (*See* Mirexus Clean Copy of Claims, Paper 7.)

The '608 patent provides another way of calculating polydispersity through distribution of the molecular weight of polymer. (*See* '608 patent, Ex. 2009, 5:23–27.) This calculation is defined as the ratio of weight average molar mass ("M*w*") to the number average molar mass ("M*n*") and is referred to as the PDI*. (*See id.*) In contrast to the evaluation of PDI measured by DLS, the '608 patent explains that a monodisperse material evaluated by this technique has a PDI* close to one (1.0). (*See id.* at 5:27–29.)

Mirexus argues that PRF's claims do not expressly recite limitations to "monodisperse" nanoparticles or to nanoparticles "having a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS)." (*See* Mirexus Motion 3, Paper 175, 16:15-20) .Because the plain language of claim 17 supports this argument, we agree.

In opposition, though, PRF argues that these claim terms do not limit Mirexus claim 17. First, PRF argues that the term "monodisperse" and "having a polydispersity index of less than 0.3 as measured by . . . DLS" mean the same thing within the context of Mirexus claim 17. (*See* PRF Opp. 3, Paper 190, 3:8–5:16.) PRF cites to Table 1 of the '608 patent, which purports to provide DLS

determinations for phytoglycogen nanoparticles prepared according to Example 2, a method within the scope of Mirexus claim 17. The PDI determinations of 15 samples reported in Table 1 are all less than 0.3, but range from 0.053 to 0.129. None of the PDI determinations reported in Table 1 are 0.0, the value noted in the '68 patent regarding monodispersity. (*See* '608 patent, Ex. 2009, 5:27–28 ("In the first case [using DLS measurement], monodisperse material has PDI close to zero (0.0) . . . .").) PRF notes further that the '608 patent allows for PDI values of "less than about 0.3, less than about 0.2, less than about 0.15, less than about 0.10, less than 0.07 or less than 0.05 as measured by DLS," as being embodiments of the invention of "a composition of monodisperse nanoparticles." (*Id.* at 5:15–33; *See* PRF Opp. 3, Paper 190, 3:13–18.)

According to PRF, the term "monodisperse" in Mirexus claim 17 does not mean having a PDI of 0.0, but rather allows for higher PDIs. PRF concludes that "consistent with its specification, and since the particles are not uniform . . . 'monodisperse' must mean a particle population with 'a PDI of less than 0.3 as measured by DLS.'" (PRF Opp. 3, Paper 190, 3:18–20 (citations omitted).)

Mirexus argues that PRF is wrong because of the grammatical construction of claim 17. (*See* Mirexus Reply 3, Paper 201, 2:11–21.) According to Mirexus, the term "monodisperse" modifies the term "nanoparticle" in claim 17, whereas the term PDI modifies the term "aqueous composition." (*See id.*) Mirexus argues that the term "monodisperse" describes other attributes of composition, including the components, or particles of interest, the homogeneity of the composition, the molecular or particle size range, and the molecular weight or size distribution histograms, but Mirexus presents no argument or evidence that the method of

claim 17 is limited to any of these characteristics other than PDI as measured by DLS. (*See* Mirexus Reply 3, Paper 201, 3:9–16, citing Yada Decl., Ex. 2001, ¶¶ 43–47.)

Even if Mirexus is correct, this argument does not explain why the terms "monodisperse" and "[PDI] less than 0.3" do not limit claim 17 to the same degree and therefore, in the context of claim 17, are not the same. Mirexus does not argue that the method of claim 17 produces phytoglycogen nanoparticles that are limited by any characteristic other than a PDI of less than 0.3. Thus, neither Mirexus's argument nor claim 17 indicate other characteristics that define a method within the scope of the claim.

After considering both parties' positions, we are persuaded that claim 17 is limited to a method of obtaining an aqueous composition comprising monodisperse nanoparticles, which in the context of claim 17 means that the nanoparticles have a PDI of less than 0.3 as determined by DLS. That is, we find that in claim 17 the term "monodisperse" is limited to nanoparticles that have a PDI of less than 0.3 as measured by DLS and not to any other determinations of polydispersity or monodispersity.

PRF argues further that the term limiting the PDI to less than 0.3 is not limiting because it is merely the result of the claimed method. (*See* PRF Opp. 3, Paper 190, 5:17–6:12.) PRF argues, citing *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990), and other cases, that new benefits of old methods and the claims to a natural result that flows from a prior art method are not patentable. (*See id.* at 5:18–6:5.) We agree with PRF that if the prior art discloses the very same methods, then the particular benefits must naturally flow from those methods even

if not recognized as benefits at the time of the patent disclosure. *See Perricone v. Medicis Pharm. Corp*., 432 F.3d 1368, 1378 (Fed. Cir. 2005); *see also Bristol–Myers Squibb Co. v. Ben Venue Labs., Inc.,* 246 F.3d 1368, 1376 (Fed.Cir.2001) (explaining that newly discovered results of known processes are not patentable because those results are inherent in the known processes).

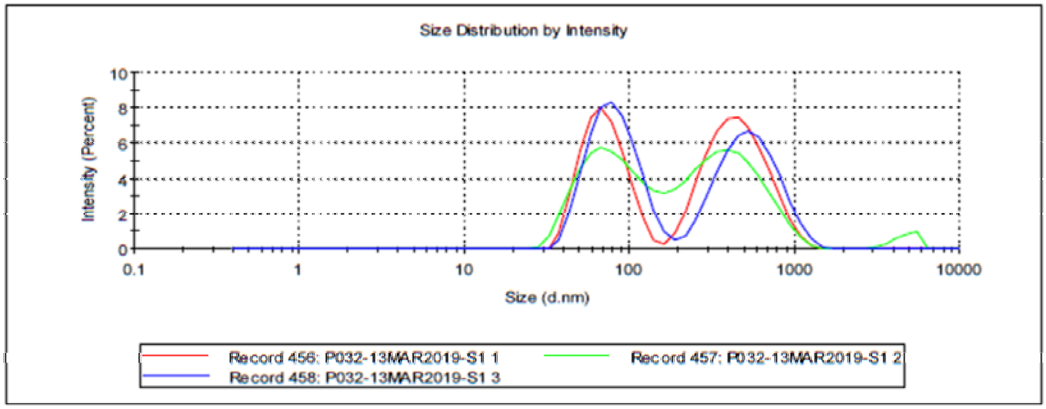
In the current inquiry, though, the issue presented by Mirexus Motion 3 is whether the parties' claims interfere. To make that determination, we look, in part, to whether Mirexus claim 17 would be anticipated or rendered obvious by PRF claim 1, if PRF claim 1 were prior art to it. *See* 37C.F.R. § 41.203(a). Thus, the prior art context in which we evaluate the terms of Mirexus claim 17 is PRF claim 1. Mirexus claim 17 includes a step not recited in PRF claim 1: "passing the aqueous extract of step (b.) through a microfiltration material having a maximum average pore size of between about 0.05 and 0.15 μm." (*See* Mirexus Clean Copy of Claims, Paper 7.) Thus, Mirexus claim 17 does not necessarily recite an "old" process within the context of an interference-in-fact inquiry. In the context of no interference-in-fact, PRF has not persuaded us that the term "having a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS)" carries no weight for our inquiry.

In summary, we conclude that Mirexus claim 17 is limited to a method of preparing phytoglycogen by the recited steps to produce a composition "having a polydispersity index of less than 0.3 as measured by dynamic light scattering (DLS)." We turn to the question of whether the method of PRF claim 1 is also limited by this element.

B.

"[A] prior art reference may anticipate without disclosing a feature of the claimed invention if that missing characteristic is necessarily present, or inherent, in the single anticipating reference." *Schering Corp. v. Geneva Pharm.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003). Mirexus relies on the testimony of Dr. Yada to argue that PRF claim 1 does not produce the same composition of phytoglycogen nanoparticles as Mirexus claim 17 and, therefore, does not inherently recite the same method as Mirexus claim 17. (*See* Mirexus Motion 3, Paper 175, 13:5–12.)

Dr. Yada testifies that he performed the experiment disclosed in Example 1 of PRF's '412 application and did not obtain a phytoglycogen nanoparticle with a PDI of less than 0.3. (*See* Yada Decl., Ex. 2001, ¶¶ 138–44.) Specifically, Dr. Yada refers to Exhibit 2018 for results of the procedure he used to repeat Examples 1 and 2 of PRF's '412 application. The graph in Exhibit 2018 is reproduced below.



The graph is entitled "Size Distribution by Intensity," with an x-axis labeled "Size (d.nm) and a y-axis labeled "Intensity (Percent)." The graph contains three plots, which Dr. Yada explains are three separate measurements of the final product

obtained from the reproduction of PRF's '412 application Examples 1 and 2. (*See id.* at ¶ 142.)

Dr. Yada testifies that the graph shows the final product "produces at least a bimodal size distribution," with a third peak detected in one of the measurement runs. (*Id.* at ¶ 141.) Dr. Yada reports that the mean PDI from the measurements provided in Exhibit 2018 is 0.490 and the standard deviation is $\pm$ 0.010. (*Id.* at ¶ 142.) According to Dr. Yada, one of ordinary skill in the art would have rounded the PDI measured in his experiments to 0.5 in order to consider them with one significant figure, as the claimed PDI value of "less than 0.3" is expressed. (*See id.*)

Dr. Yada concludes from his reproduction of Examples 1 and 2 of the '412 application that the final product of PRF claim 1 does not meet the limitation of "having a PDI of less than 0.3" as required in claim 17 of the Mirexus '608 patent. (*See id.*) Dr. Yada testifies that one of ordinary skill in the art would have understood that the final product of claim 1 of the '412 application is not monodisperse. (*See id.* at ¶ 143.)

PRF does not dispute that Dr. Yada followed the protocols provided in Examples 1 and 2 of its '412 application or that these protocols are an embodiment of its involved claim 1. Instead, PRF argues that Dr. Yada's analysis is faulty because the distribution of phytoglycogen should be "monomodal," with a single peak, unlike the distribution of glycogen, which PRF asserts is "bimodal." (*See* PRF Opp. 3, Paper 190:9:14–16.) PRF argues that because a phytoglycogen distribution has a single peak, and the size of phytoglycogen particles ranges from

50–200 nm, the "right peak" in the data presented by Dr. Yada must be starch. (*See id.* at 9:17–10:2.)

PRF argues further that even if the "right peak" in Exhibit 2018 is material other than phytoglycogen, the final product produced by Dr. Yada is encompassed by Mirexus claim 17 because the claim recites a composition "comprising" monodisperse phytoglycogen nanoparticles and therefore allows other components in the composition. (*Id.* at 10:3–4.)

PRF continues it argument with an analysis of PDI for the "left peak" alone. Specifically, PRF argues

> [u]sing a left-peak average of 75 nm and a PDI of 0.3 in Mirexus' PDI equation yields a standard deviation of just over 41 nm. That is, if at least 68 percent . . . of the particle sizes are between 34 and 116 nm, then the PDI is less than 0.3. From visual observation, the left peak appears to meet that condition, and Mirexus has not suggested otherwise. It is likely that Ex. 2018 shows a composition comprising "monodisperse"/"PDI less than 0.3" phytoglycogen, plus whatever the right peak is.

(PRF Opp. 2, Paper 190, 10:5–10 (referring to page 5 of PRF Opposition 2 for the reference to 68 percent of the particle sizes in the omitted text).)

The references cited by Dr. Yada support PRF's argument that a phytoglycogen distribution is a single peak. For example, Exhibit 2107 states that "[t]he molecular size distribution of liver glycogen is bimodal, with distinct α and β components, while that of phytoglycogen is monomodal." (*See* Ex. 2107, abstract; *see* PRF Opp. 3, Paper 190, 9:14–16.) Furthermore, Dr. Yada testifies that glycogen particles have a size ranging from 50–200 nm, whereas the second ("right") peak in the data reported by Dr. Yada is outside of that range. (*See* Yada

Decl., Ex. 2001, ¶ 114; *see* PRF Opp. 3, Paper 190, 9:17–10:2.) Nevertheless, PRF has not provided sufficient support for its argument about the specific data resulting from Examples 1 and 2 of the '412 application as performed by Dr. Yada.

Without an analysis of Dr. Yada's specific data by a witness who can testify about the understandings of those having ordinary skill in the art, we are not persuaded that Dr. Yada's analysis is incorrect. We have insufficient basis to find that one of ordinary skill in the art would have related the generalized reports cited by PRF to the specific data presented by Dr. Yada to determine that only the first ("left") peak in the figure of Exhibit 2018 is phytoglycogen. PRF fails to provide sufficient evidence, such as contrary cross-examination testimony of Dr. Yada or the testimony of another casting doubt on Dr. Yada's conclusions. PRF's arguments about how one of ordinary skill in the art would have determined the PDI of the "left peak" alone is similarly unsupported. Thus, we are not persuaded by credible evidence that Dr. Yada's conclusions about the PDI from the data reported in Exhibit 2018 are incorrect. (*See* PRF Opp. 3, Paper 190, 10:3–10.)

We are persuaded by Dr. Yada's testimony that the method of PRF's claim 1 does not necessarily produce phytoglycogen nanoparticles with a PDI of less than 0.3 as determined by DLS. We are persuaded that the method recited in PRF claim 1 is not identical to the method recited in Mirexus claim 17. Thus, whether or not the limitation to nanoparticles with a PDI less than 0.3 as determined by DLS is the natural result of the method recited in Mirexus claim 17, it highlights the difference between the parties' claims. Said another way, we are persuaded that PRF claim 1 does not anticipate Mirexus claim 17 due to the limitations

recited in claim 17 not recited in claim 1, for example as microfiltration through material having a maximum average pore size of between about 0.05 and 0.15 μm.

C.

Given our finding that the method recited in PRF claim 1 does not produce phytoglycogen nanoparticles as recited in Mirexus claim 17, we turn to whether it would have been obvious to one of ordinary skill in the art to use the method of Mirexus claim 17, if the method of PRF claim 1 were prior art. *See* 37 C.F.R. § 41.203(a).

As discussed above, Mirexus claim 17 requires "passing the aqueous extract of step (b.) through a microfiltration material having a maximum average pore size of between about 0.05 and 0.15 μm . . . ." (*See* Mirexus Clean Copy of Claims, Paper 7, 2.) Mirexus argues that this step would not have been obvious if PRF claim 17 were prior art. (*See* Mirexus Motion 3, Paper 175, 21:9–22:11.) Specifically, Mirexus argues that there would not have been a motivation to use a two-step filtration method and that it would not have been reasonable to expect that such a method would produce monodisperse phytoglycogen nanoparticles. (*See id.* at 21:14–20.)

According to Mirexus, although phytoglycogen nanoparticles had been reported in the literature before the parties' filing dates, they were known to be polydisperse, not monodisperse. (*See id.* at 14:16–15:19, citing, e.g., Putaux, Ex. 2056; *see also* Yada Decl., Ex. 2001, ¶¶ 102-111.) Mirexus cites to publications such as Powell et al., published in 2013, which refers to the wide size distribution of particles obtained by purifying phytoglycogen. (*See* Powell, Ex. 2108, 430; *see* Mirexus Motion 3, Paper 175, 15:15–19.)

Mirexus argues that before 2011 there was no market demand for monodisperse phytoglycogen nanoparticles because the methods known to prepare phytoglycogen then were known to make polydisperse nanoparticles. (*See* Mirexus Motion 3, Paper 175, 16:20–17:6, citing Yada Decl., Ex. 2001, ¶¶ 54–60.) Mirexus argues that the art, and even PRF's '412 application, failed to recognize that monodisperse phytoglycogen particles could be produced. (*See* Mirexus Motion 3, Paper 175, 17:23–20:20.) Mirexus argues further that the art relating to production of glycogen, a similar particle, would not have motivated an ordinarily skilled artisan to develop a method to produce monodisperse phytoglycogen nanoparticles because it was known that glycogen was polydisperse. (*See* Mirexus Motion 3, Paper 175, 20:23–21:8, citing Yada Decl., Ex. 2001, ¶¶ 130-132.)

Mirexus argues that beyond the lack of motivation to make monodisperse phytoglycogen nanoparticles, there would have been no motivation for one of ordinary skill in the art to use a two-step filtration method. (*See* Mirexus Motion 3, Paper 175, 21:11–22:11, citing Yada Decl., Ex. 2001, ¶¶ 133–137.) Dr. Yada explains that the microfiltration step recited in Mirexus claim 17 imposes an upper boundary, removing compounds greater than the pore size of the filter (between about 0.05 and 0.15 μm), whereas the ultrafiltration step imposes a lower boundary and removes compounds smaller than 300 kDa. (*See* Yada Decl., Ex. 2001, ¶ 134.) According to Dr. Yada, those of ordinary skill in the art were generally aware of different techniques to separate and purify products, including chromatography, precipitation, and filtration. (*See id.* at ¶ 135.) But Dr. Yada testifies that it was also known to use other methods, such as solvents, heat adjustment, pH adjustment, or enzymatic treatment, to cause precipitation of different components.

(*See id.*) In Dr. Yada's opinion, there was no suggestion in the art that the method of Mirexus claim 17 would produce monodisperse phytoglycogen nanoparticles. (*See id.*) Relying on this testimony, Mirexus argues that there was no indication in the art to suggest that the filtration steps of Mirexus claim 17 would provide a useful way to produce monodisperse phytoglycogen nanoparticles. (*See* Mirexus Motion 3, Paper 175, 21:23–22:2.)

Mirexus's argument is mostly an argument that one of ordinary skill in the art would not have had a motivation or a reasonable expectation of success in making monodisperse phytoglycogen nanoparticles. Specifically, Mirexus argues that there was no indication in the art that the use of a microfiltration step with an average pore size between about 0.05 and 0.15 μm would produce a monodisperse product. (Mirexus Motion 3, Paper 175, 22:2–5.) In support, Dr. Yada testifies that there would not have been a reasonable expectation that a two-step filtration method would produce monodisperse phytoglcyogen nanoparticles with a PDI of less than 0.3 because it was known that microfiltration eliminates molecules based only on the particle size, not the other characteristics that are uniform in a monodisperse product. (*See* Yada Decl., Ex. 2001, ¶ 136.) Dr. Yada testifies further that because the molecular weight of phytoglycogen overlaps other particles, such as amylopectin, one of ordinary skill in the art would have understood that filtration would not be able to produce monodisperse phytoglycogen nanoparticles. (*See id.* at ¶ 137.) According to Dr. Yada, one of ordinary skill would use a more refined technique, such as chromatography, to remove molecules based on the physicochemical characteristics of the molecule, rather than just size. (*See id.*) Dr. Yada testifies that one of ordinary skill in the

art would not have expected to be able to produce monodisperse phytoglycogen nanoparticles using filtration. (*See id.*)

PRF opposes Mirexus's argument regarding the nonobviousness of Mirexus claim 17 over PRF claim 1 on several grounds. In general**,** PRF argues that the filtration pore size recited in Mirexus claim 17 is not critical to preparing phytoglycogen nanoparticles with a PDI of less than 0.3 and that the difference in the parties' claims is merely an obvious difference in size. (*See* PRF Opp. 3, Paper 190, 12:15–18.) PRF's argument is based, in part on the assertion that "[o]ne of ordinary skill would expect successful production of phytoglycogen having a PDI less than 0.3 using the pore sizes recited in Mirexus' Claim 17. Putaux [the prior art reference cited by Mirexus] demonstrated production of such phytoglycogen using microfiltration with 46μm and 0.2 μm pores." (*Id.* at 13:5–12; *see also id.* at 12:17–18.)

According to PRF, Putaux published a report of phytoglycogen nanoparticles with a PDI less than 0.3 in 2009. (*See id.* at 6:13–7:14, citing Putaux, Ex. 2110.) Specifically, PRF relies on the report in Putaux of particles having an average diameter of 46.9 nm, with a standard deviation of 11.7, in the column entitled "Negative Staining" of Table 1. (*See* PRF Opp. 3, Paper 190, 7:3–9, citing Putaux, Ex. 2110, at 148, Table 1.) Using the definition of PDI provided in the '608 patent, wherein PDI = $(\sigma/d)^2$, with σ being the standard deviation and d being the average diameter, counsel for PRF calculates that the PDI of the particles reported in Putaux is 0.0622. (PRF Opp. 3, Paper 190, 7:5–7.) PRF performs the same calculation on the data in the column entitled "Cryo-TEM" in Table 1 of

Putaux, which reports an average diameter of 55.8 nm and a standard deviation of 13.4 nm, to obtain a PDI of 0.0577. (*See* PRF Opp. 3, Paper 190, 7:7–9.)

PRF concludes from these calculations that both sets of data in Table 1 show nanoparticles with a PDI approximating 0.06, which PRF notes is well within the scope of the PDI recited in Mirexus claim 1. (*See* PRF Opp. 3, Paper 190, 7:12–14.) PRF argues further that the results in Putaux show that the concept of low PDI phytoglycogen nanoparticles was known in the prior art. (*See id*.)

Mirexus disputes PRF's characterization of the data reported in Putaux, arguing that PRF uses the wrong calculations. (*See* Mirexus Reply 3, Paper 201, 6:11–7:4.) Specifically, Mirexus argues that PRF's counsel uses a DLS-based calculation with data that was not collected by DLS. (*See id.* at 6:15–16.) Mirexus argues that Putaux provides molecular weight data that would be used to determine a PDI* value instead of the DLS-based PDI values calculated by PRF. Mirexus argues further that when the proper calculation is used, a PDI* value of 1.64 is obtained – not the lower PDI values of approximately 0.06 asserted by PRF. (*See id.* at 6:18–7:3, citing Yada Decl., Ex. 2001, ¶¶ 107–108.)

Mirexus relies on Dr. Yada's testimony to support its argument. (*See* Mirexus Reply 3, Paper 201, 6:18–7:3.) Dr. Yada testifies:

> Putaux *et al*. calculated a diameter-polydispersity index by computing the mean diameters, in number, Dn, and weight, Dw. ([Putaux, Ex. 2110] at 148.) The diameter polydispersity index D_w/D_n values were calculated by the authors, based on measurements of the diameters of about 1000 particles (both stained using TEM or embedded in ice using cryo-TEM), as provided by the authors in Table I. (Ex. 2110 at 148.) For the cryo-TEM results, the diameter polydispersity index is D_w/D_n = 65.7 nm/55.8 nm = 1.18. (*Id*.)

> However, a POSA would understand that the PDI as expressed in Putaux *et al.* is not directly proportional to the molecular weight distribution of the particle. In order to convert the PDI to be a reflection of the molecular weight, a POSA would convert the diameter into a volume ratio—*i.e.*, $(D_w/D_n)^3$. The resulting PDI based on molecular weight called PDI* in the '608 patent would be about 1.64. A POSA would thus understand that this PDI is greater than a PDI of 0.3 as measured by DLS taking into account the differing scales in the tests.

(Yada Decl., Ex. 2001, ¶¶ 107–108.) Thus, Dr. Yada testifies that the PDI* of the phytoglycogen nanoparticles reported in Putuax would be 1.64. This PDI is higher than that determined by PRF and is not within the scope of Mirexus claim 1.

PRF does not cite to any support, such as the testimony of a qualified witness, for its calculations from the data in Putaux. Nor does PRF present cross-examination testimony of Dr. Yada that casts doubt on his declaration testimony. Because we find Dr. Yada qualified to testify to the knowledge of a person of ordinary skill in the art at the time when the parties' relevant applications were filed and PRF has not presented contradictory evidence, we are persuaded by Dr. Yada's testimony that Putaux does not report phytoglycogen particles within the scope of Mirexus claim 1. PRF's argument that phytoglycogen nanoparticles having a polydispersity index of less than 0.3 as measured by DLS was known in the prior art is unsupported and we are not persuaded by it. Accordingly, we are not persuaded that an ordinarily skilled artisan would have expected producing a composition of phytoglycogen of PDI less than 0.3 would be successful with microfiltration on the basis of Putaux.

PRF argues further that a difference in size is obvious unless it is shown to be critical, citing *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990). (*See* PRF Opp. 3, Paper 190, 12:7–15.) PRF asserts that "[t]he [microfiltration] pore size cited in Claim 17 is not critical to a composition comprising phytoglycogen nanoparticles, nor to preparing such particles having a PDI less than 0.3." (*Id.* at 12:15–17 and 16:13–19.)

PRF argues further that Putaux and its '412 application demonstrate that particulates could be removed by several different methods, including filtration through a sieve or other microfiltration device, or by centrifugation, or both. (*See id.* at 12:19–23.) According to PRF, the methods used in Putaux and its '412 application are known alternatives used for their usual purpose. Putaux argues that, thus, under *KSR Int'l Inc. v. Teleflex Inc.*, 550 U.S. 398, 416–17 (2007), the microfiltration recited in Mirexus claim 17 would have been obvious. (*See* PRF Opp. 3, Paper 190, 12:23–13:2.)

Relying on an admission made by Mirexus, PRF argues that those of ordinary skill in the art knew that microfiltration eliminates particles larger than the size of the particles retained by the specific pore size. (*See id.* at 11:6–8, citing Yada Decl., Ex. 2001, ¶ 170.) PRF cites to Dr. Yada's testimony that one of ordinary skill in the art would have understood that to produce a monodisperse product with a PDI of less than 0.3, one would need a product that has high purity and a narrow size distribution. (*See* PRF Opp. 3, Paper 190, 11:8–10, citing Yada Decl, Ex. 2001, ¶ 136.) PRF argues further that microfiltration was known for preparation of phytoglycogen nanoparticles, citing several exhibits. (*See* PRF Opp. 3, Paper 190, 11:15–17.) For example, Putaux provides a method for preparing a

maize phytoglycogen suspension that includes filtering through a 0.2-µm mesh filter. (*See* PRF Opp. 3, Paper 190, 11:15–19, citing Putaux, Ex. 2110, at 146, ¶ 2.1) PRF concludes that "[t]he person of skill in this art had reason to use microfiltration with a 0.15 µm filter (or finer) for a purpose for which microfiltration at similar pore sizes has been previously used, and would expect that he or she could use it successfully." (*See* PRF Opp. 3, Paper 190, 11:19–22.)

PRF does not cite to support for its assertion of the reasons one of ordinary skill would use microfiltration. According to PRF, "mere determination of optimal size, or change of size, is obvious" (*Id.* at 11:22–23), but there must still be a reason the skilled artisan would make such a change. As explained in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007),

> [o]ften, it will 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, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

PRF fails to cite a reason, supported by testimony or other evidence, why one of ordinary skill in the art would have considered it obvious to use microfiltration through a material having a maximum average pore size of between about 0.05 and 0.15 µm with the method of PRF claim 1.

In contrast, Mirexus offers Dr. Yada's testimony that the techniques being used to isolate phytoglycogen at the time maximized yield, but did not produce a monodisperse product. (*See* Mirexus Motion 3, Paper 175, 17:9–20, citing Yada

Decl., Ex. 2001, ¶¶ 54–60 and 116–118.) Mirexus argues further that it was known that conventional techniques, such as heat, pH, and enzymatic treatment degraded phytoglycogen and produced a polydisperse product and that those of ordinary skill in the art would not have been motivated to stop using these techniques, which enhance purity. (*See id.*)

PRF does not offer contradictory testimony or cross-examination testimony of Dr. Yada that casts doubt on testimony cited by Mirexus. Accordingly, we have no evidentiary basis on which to determine that Mirexus is wrong and PRF is right about the reason why one of ordinary skill in the art would or would not have considered it obvious to use microfiltration through a 0.05 to 0.15 μm in the method of PRF claim 1.

PRF also argues that

> [s]ince smaller-pore microfiltration would remove the same particles and others larger than phytoglycogen (Ex. 2001, e.g. ¶170) the same or better PDI result as Putaux obtained would be expected. Smaller-pore microfiltration will not generate a wider standard deviation of phytoglycogen particles. There is no basis to suggest a lack of an expectation of success using microfiltration with smaller pores than are explicitly noted in Putaux and the '412 Application.

(PRF Opp. 3, Paper 190, 13:7–12.) PRF concludes that "a microfiltration step for the purpose of preparing phytoglycogen particles is prior art to Mirexus' claims, and the specific pore size range in Claim 17 is not distinguishing." (*Id.* at 13:13–16.) According to PRF, the smaller pore size recited in claim 17 would be used for the same purpose as the microfiltration step of Putaux and another prior art

reference, Inouchi (Ex. 1020), and would achieve the same results. (*See* PRF Opp. 3, Paper 190, 13:13–16.)

Even if it would be obvious that using a smaller pore-size microfiltration would generate a smaller narrower standard deviation of phytoglycogen particles, PRF fails to support its argument that one of ordinary skill in the art would have had a reason to make this modification of the method recited in Mirexus claim 17.

Instead, we are persuaded by the testimony of Dr. Yada that

> [a]s of the critical date, scientists in art were not focused on developing particular size distribution patterns of phytoglycogen. This is at least in part due to the fact that commercial applications used phytoglycogen as a food additive or in cosmetic products—neither of which would have required phytoglycogen to be produced as monodisperse nanoparticles. . . . Based up[on] my review, the prior art appears to have been more concerned with the common food industry concepts of creating phytoglycogen extracts or preparations—not on producing monodisperse nanomaterials.

(Yada Decl., Ex. 2001, ¶ 59.) PRF does not direct us to evidence contradicting Dr. Yada's testimony or evidence of other considerations those of ordinary skill in the art would have made. Therefore, we are not persuaded that even if the technology existed to generate a narrower standard deviation of nanoparticles, one of ordinary skill in the art would have disregarded the known methods of purification that increase polydispersity (altering temperature or pH or adding enzymes, etc.) to obtain a more monodisperse preparation.

After weighing the parties' arguments and evidence in support, we conclude that Mirexus claim 17 would not have been obvious over PRF claim 1 because Dr. Yada testifies that there would not have been a reason to use microfiltration as recited in Mirexus claim 17 in the method of claim 1.

Conclusion

Mirexus has presented evidence to meet its burden of showing that PRF claim 1 does not anticipate or render obvious Mirexus claim 17. PRF fails to present sufficient evidence to the contrary. Because none of PRF's other involved claims recite the limitation to microfiltration identified by Mirexus, we are persuaded that none of PRF's claims anticipate or render obvious any of the involved Mirexus claims. Accordingly, we grant Mirexus Motion 3.

Order

It is

ORDERED that Mirexus Motion 3 is GRANTED;

FURTHER ORDERED that Mirexus Motions 2 and 4 and PRF Motions 1 and 3 are DISMISSED as moot; and

FURTHER ORDERED that judgment terminating the interference will be entered in a separate paper to follow.

Interference 106,101

cc (via e-mail):

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