

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

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Ex parte DONALD W. PETERSEN,  
KELLY C. RICHELSON,  
WARREN O. HAGGARD,  
CARY P. HAGAN and  
DONALD A. RANDOLPH

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Appeal No. 2006-0704<sup>1</sup>  
Application No. 10/060,697

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ON BRIEF

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Before ADAMS, GRIMES and LEOVITZ, Administrative Patent Judges.

Opinion by GRIMES, Administrative Patent Judge.

Concurring opinion by ADAMS, Administrative Patent Judge.

DECISION ON APPEAL

This appeal involves claims to a bone graft composition, which the examiner has rejected for obviousness and obviousness-type double patenting. We have jurisdiction under 35 U.S.C. § 134. We affirm the rejections for obviousness-type double patenting but reverse the rejection for obviousness.

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<sup>1</sup> The rejections on appeal in this application are similar to those in commonly assigned applications 09/327,761 (Appeal No. 2006-0766) and 09/947,833 (Appeal No. 2006-2627). Accordingly, we have considered these appeals together.

### Background

“Calcium sulfate has been clinically used for many years as a bone void filler with successful results.” Specification, page 1. Calcium sulfate hemihydrate is also known as Plaster of Paris. See Yim,<sup>2</sup> column 2, lines 60-62. The specification discloses a “bone graft substitute composition [that] comprises, in general, a quantity of calcium sulfate, a quantity of fluid (e.g., sterile water), and a quantity of a plasticizing substance (e.g., carboxymethylcellulose) which provides a resultant composition that is robust and has an extended set time.” Specification, page 3.

The “extended set time . . . provides a useful working time of at least 5 minutes to allow sufficient time for a surgeon to properly apply the bone graft substitute composition, while the robustness of the resultant composition allows the implanted composition to withstand the typical pressure of body fluids, irrigation fluids and/or suctioning with minimal material erosion, disintegration or dissolution.” Id. “The composition may include a bioactive agent selected from the group consisting of demineralized bone matrix, growth factors, hyaluronic acid, bone morphogenic proteins, bone autograft, and bone marrow, etc.” Id., page 4.

### Discussion

#### 1. Claims

Claims 16-30 are pending and on appeal. Claim 16 is representative and reads as follows:

16. A bone graft substitute composition, comprising:
  - calcium sulfate;
  - demineralized bone matrix;

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<sup>2</sup> Yim et al., U.S. Patent No. 5,385,887, issued January 31, 1995 (of record).

cancellous bone;  
a plasticizing substance; and  
a mixing solution.

Thus, claim 16 is directed to a bone graft substitute comprising (among other things) calcium sulfate, a mixing solution, and a plasticizing substance. The specification states that mixing solutions include water and phosphate buffered saline, and that plasticizing substances include cellulose derivatives such as hydroxypropyl methylcellulose. See page 3, line 28 to page 4, line 3.

The claimed composition also comprises demineralized bone matrix and cancellous bone. Cancellous bone is said to “provide the composition with good structural support, and the relatively large surface area of the cancellous bone chips can provide the composition with good osteoconduction.” Specification, page 10, lines 29-31.

## 2. Obviousness

The examiner has rejected claims 16-30 under 35 U.S.C. § 103 as obvious in view of O’Leary,<sup>3</sup> Yim and Wironen.<sup>4</sup> See the Examiner’s Answer, page 3. The examiner cites O’Leary’s disclosure of “a composition . . . comprising demineralized osteogenic bone powder and a biocompatible liquid synthetic organic material as a carrier for the bone powder with or without such optional ingredients as thixotropic agents, medicaments, and the like.” Id. The examiner notes that O’Leary also suggests that

[w]here . . . the bone powder has a tendency to quickly or prematurely separate from the carrier . . . , it can be advantageous to include within the composition a substance whose thixotropic characteristics prevent or reduce this tendency. Thus, e.g., where the carrier component is glycerol

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<sup>3</sup> O’Leary et al., U.S. Patent No. 5,484,601, issued January 16, 1996.

<sup>4</sup> Wironen et al., WO 98/40113, published September 17, 1998.

and separation of bone powder occurs to an excessive extent where a particular application is concerned, a thickener such as a . . . cellulosic ester such as hydroxypropyl methylcellulose . . . can be combined with the carrier in an amount sufficient to significantly improve the suspension-keeping characteristics of the composition.

Id., pages 4-5 (emphasis added).

The examiner concludes that O'Leary therefore "provides the motivation to produce a bone graft substitute composition comprising a mixing solution [i.e., biocompatible liquid synthetic organic material such as glycerol], a plasticizing substance [i.e., hydroxypropyl methylcellulose] . . . and demineralized bone matrix."

Id., page 5.

The examiner acknowledges that O'Leary does not teach a composition comprising calcium sulfate, but cites Yim for this limitation. See the Examiner's Answer, page 6. The examiner notes that Yim teaches compositions for promoting the growth of bone comprising bone morphogenic proteins and a calcium sulfate hemihydrate-containing substance (CSHS). Id. The examiner notes that Yim's compositions can also contain hydroxypropyl methylcellulose, among other things, as a "protein-sequestering agent." Id., page 7. Thus, the examiner finds that Yim discloses

a bone graft substitute composition, similar to O'Leary et al., which contains calcium sulfate, a mixing solution [i.e., "water or saline or other buffers"; Examiner's Answer, page 9, line 16], and a plasticizing substance [i.e., hydroxypropyl methylcellulose] and which has improved moldability and consistency.

Id., page 9.

The examiner concludes that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the composition of O'Leary et al., with components of the composition of Yim et al." Id., page 10. Specifically, "[o]ne of

ordinary skill in the art . . . would have been motivated to include a calcium sulfate component into the composition of O'Leary et al. with the expected benefit disclosed by Yim et al., i.e. that a calcium sulfate component would add improved handling, moldability and consistency to the formulation of O'Leary as well as reducing the set up time." Id., pages 10-11.

The examiner acknowledges that O'Leary and Yim do not teach compositions comprising cancellous bone, but cited Wironen for this limitation. The examiner characterizes Wironen as disclosing "a bone paste for the repair of bone defects" and noted that Wironen

states that the composition "may act as a carrier for cortical, cancellous or cortical and cancellous bone chips. Such compositions are useful for filling larger bone voids. In addition, when these bone chips are not demineralized, they provide an added spectrum of biological properties not exhibited by the gelatin alone or the gelatin plus the osteogenic components."

Id., page 12. The examiner concludes that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to include cancellous bone chips into the composition of O'Leary . . . [because] they fill larger bone voids and provide an added spectrum of biological properties to the composition." Id.

Appellants argue that those skilled in the art would not have been led to combine Yim and O'Leary as posited by the examiner:

[T]he Yim reference only suggests that a calcium sulfate hemihydrate-containing substance (CSHS) provides [improved handling, moldability and consistency] when combined with the formulation described in U.S. Pat. No. 5,171,579 (see column 2, lines 51-65). Yim only suggests a CSHS provides such advantages in the context of a formulation comprising osteogenic proteins, autogenous blood, and a porous particulate polymer matrix. . . . There is no suggestion in the Yim reference that such improved properties would be expected in any other

formulation. . . . Further, there is nothing in the O'Leary reference to suggest a problem with moldability, consistency, etc. . . . that might lead one of ordinary skill in the art to seek an additive to address such a problem.

Appeal Brief, pages 6-7.

“In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a prima facie case of obviousness.” In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). “[T]o establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant.” In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1316 (Fed. Cir. 2000). An adequate showing of motivation to combine requires “evidence that ‘a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.’” Ecolochem, Inc. v. Southern Calif. Edison Co., 227 F.3d 1361, 1375, 56 USPQ2d 1065, 1076 (Fed. Cir. 2000).

In this case, we agree with Appellants that the examiner has not adequately explained how the cited references would have suggested the composition of claim 16 to those of ordinary skill in the art. As recognized by the examiner, the composition of claim 16 has five components: calcium sulfate, a mixing solution, a plasticizing substance (e.g., hydroxypropyl methylcellulose), demineralized bone matrix, and cancellous bone.

O'Leary discloses a composition for use in bone repair that has two required ingredients: demineralized bone powder and a “biocompatible liquid synthetic organic

material as carrier therefor.” See column 1, lines 49-51. Suitable carriers are said to “include liquid polyhydroxy compounds and their esters, polysaccharides, surface active agents, and the like. . . . [G]lycerol is especially preferred.” Column 3, lines 36-49.

O’Leary teaches that “[a]ny of a variety of substances can be introduced into the bone particles,” including (among many other things) “bone morphogenetic [sic] proteins.” See column 2, line 53 to column 3, line 12. O’Leary also teaches that, in compositions where the bone powder settles out or separates from the carrier, a thickener can be added; suitable thickeners include hydroxypropyl methylcellulose. See column 3, line 56 to column 4, line 6.

Thus, O’Leary teaches a composition that necessarily contains demineralized bone powder and a carrier (preferably glycerol) and may contain numerous other components, including bone morphogenic proteins and hydroxypropyl methylcellulose. O’Leary teaches that “[f]unctionally, the liquid component . . . serves to provide a flowable material of widely varying consistency,” from runny to putty-like. See column 3, lines 27-33.

Yim discloses compositions useful “to promote the formation of cartilage and/or bone, for repair of tissue damage and fractures.” Column 2, lines 46-47. Yim’s compositions have two required components: calcium sulfate hemihydrate-containing substance (CSHS) and an osteogenic protein. See column 2, lines 26-28. Yim’s preferred osteogenic proteins are bone morphogenic proteins (BMPs). Column 2, line 68 to column 3, line 2. Yim’s compositions also optionally contain a “porous particulate polymer matrix [and/or] an osteogenic protein-sequestering amount of autogenous blood.” Column 2, lines 16-26. “The compositions . . . may optionally

include other protein-sequestering agents,” such as hydroxypropyl methylcellulose. See column 7, lines 26-33.

Yim states that “U.S. Pat. No. 5,171,579 . . . disclosed that osteogenic proteins can be sequestered at a site where bone inducing activity is desired using autogenous blood, without using antifibrinolytic agents, provided that a porous particulate polymer matrix is incorporated into the formulation.” Column 2, lines 51-56. Yim teaches that the inclusion of CSHS “improve[s] the above formulation’s handling characteristics.”

See column 2, lines 56-65:

To reduce the preparation time and improve the above formulation’s handling characteristics, Applicants have surprisingly found that it is desirable to add a calcium sulfate hemihydrate-containing substance (CSHS). . . . Adding a CSHS reduces setup time and provides improved moldability and consistency of the resulting formulation.

In summary, then, O’Leary and Yim both teach compositions to be used in bone repair. O’Leary’s composition is a flowable mixture of demineralized bone powder and a carrier such as glycerol; it can also include hydroxypropyl methylcellulose as a thickener. Yim’s composition contains osteogenic proteins such as BMPs and calcium sulfate; it can also contain blood or another protein sequestering agent such as hydroxypropyl methylcellulose and a porous particulate polymer matrix. The calcium sulfate is disclosed to improve the handling characteristics of Yim’s composition as compared to a composition made up of osteogenic proteins, autogenous blood, and a porous particulate polymer matrix.

We do not agree with the examiner that these disclosures would have led those skilled in the art to add calcium sulfate to O’Leary’s composition. The examiner argues that the skilled artisan would have expected the addition of calcium sulfate to O’Leary’s

composition to “add improved handling, moldability and consistency.” Examiner’s Answer, page 11. Appellants, however, correctly point out that Yim does not state that calcium sulfate improves those characteristics when added to any composition, only that it does so when added to a specific prior art composition.

O’Leary does not disclose that a composition of demineralized bone powder and carrier (and optional thickener) suffers from problems of poor handling, moldability, or consistency. Nor does O’Leary state that the disclosed composition has characteristics that are comparable to a composition of osteogenic proteins, autogenous blood, and a porous particulate polymer matrix, like the one Yim discloses to be improved by the addition of calcium sulfate.

On the contrary, O’Leary discloses that demineralized bone powder can be mixed with a carrier, and optionally a thickener, to form compositions that range from runny to putty-like. See column 3, lines 30-35; column 4, lines 39-41 (“The bone powder composition . . . can be applied to the bone defect in a variety of ways, e.g., by packing the site with the composition provided in the form of a highly viscous paste”); column 5, lines 10-14 (exemplary composition of “pastelike consistency” that can be applied using a syringe or spatula). Thus, O’Leary does not disclose that its composition is in need of improved handling properties, such that those skilled in the art would have been led to modify it as taught by Yim.

The examiner has not adequately explained how the prior art would have suggested modifying O’Leary’s composition by adding calcium sulfate to it. Nor has the examiner provided a rationale based on the knowledge of those of skill in the art or the nature of the problem to be solved. Cf. In re Dembiczak, 175 F.3d 994, 999,

50 USPQ2d 1614, 1617 (Fed. Cir. 1999) (“[E]vidence of a suggestion, teaching, or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved.”). Thus, the examiner has not made out a case of prima facie obviousness. We therefore reverse the rejection of claims 16-30 under 35 U.S.C. § 103.

Our dissenting colleague would affirm the rejection. Determining obviousness under § 103 is not a completely objective analysis. Reasonable people can differ on whether a given product would have been obvious to a hypothetical person at a particular time in the past. In our view, though, the analysis set out in the dissent relies on impermissible hindsight in combining the teachings of the cited references.

As we understand it, the dissent argues that a person of ordinary skill in the art would have been led to combine the cited references because Yim teaches that calcium sulfate hemihydrate-containing substances have osteoconductive properties, O’Leary teaches that bone powder has osteoconductive properties, and Wironen teaches that various ceramics, hydroxyapatites, and “like material[s]” are osteoconductive and useful in bone repair compositions.<sup>5</sup>

In our view, this reasoning relies on the hindsight reconstruction that the courts have condemned. See Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617 (“Combining prior art references without evidence of such a suggestion, teaching, or motivation

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<sup>5</sup> The dissent also cites three patents that are of record but not relied on by the examiner. We will not further lengthen this opinion with a discussion of those references. The rejection on appeal is the one made by the examiner, not one that hypothetically could have been made. If the examiner concludes that the prior art supports a different rejection from the one reversed today, she is of course free to reject the claims on that basis.

simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability—the essence of hindsight.”).

The cited references, viewed without the benefit of the present disclosure, teach three different approaches to solving the same problem: making a composition that can be put (and will stay) in a bone defect and that promotes growth of new bone. O'Leary provides these properties by combining demineralized bone powder with glycerol. Yim provides these properties by combining bone morphogenic protein(s) with calcium sulfate hemihydrate. Wironen provides these properties by combining gelatin with an osteogenic component (e.g., demineralized bone).

Each of the prior art compositions is disclosed as a complete bone graft substitute composition having bone growth promoting properties. No doubt none of them was perfect, and each of them could have been further modified. But viewed without the benefit of hindsight, the references would not have suggested modifying the prior art compositions in a way that would produce the composition claimed here.

Patentability is determined based on a preponderance of the evidence. See In re Oetiker, 977 F.2d 1443, 1446, 24 USPQ2d 1443,1445 (Fed. Cir. 1992) (“[T]he conclusion of obviousness vel non is based on the preponderance of evidence and argument in the record.”). While the suggestion test may be flexible, it still requires evidence to show that modifying the prior art product would have been obvious. See Dystar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1366, 80 USPQ2d 1641, 1649 (Fed. Cir. 2006) (“When not from the prior art references, the ‘evidence’ of motive will likely consist of an explanation of the well-known principle or problem-solving strategy to be applied.”).

In our view, neither the examiner nor the dissent has provided evidence or reasoning to show, by a preponderance of the evidence, that the cited references would have suggested the instantly claimed composition to those of ordinary skill in the art.

### 3. Obviousness-type double patenting

The examiner rejected claims 16-30 for obviousness-type double patenting as follows:

- claims 16-30 were rejected as obvious variants of claims 6-8, 14-16, 20, and 21 of U.S. Patent No. 6,652,887 in view of Wironen;
- claims 16-30 were provisionally rejected as obvious variants of claims 1-7 and 9-24 of Application No. 09/947,833; and
- claims 16-30 were provisionally rejected as obvious variants of claims 2, 3, 8, 12-27, 29, and 32 of copending Application No. 09/327,761 in view of Wironen.

Appellants did not dispute the merits of these rejections, but “reserve[d] the right to address these rejections at a later time, either through traversal, claim amendment, or by filing terminal disclaimers, upon the indication of otherwise allowable subject matter.” Reply Brief, bridging sentence, pages 4-5.

Since Appellants have not provided any basis on which to conclude that the rejections for obviousness-type double patenting are improper, we affirm them.

### Summary

The examiner has not made out a prima facie case of obviousness, so we reverse the rejection under 35 U.S.C. § 103. Appellants have not disputed the merits of the rejections for obviousness-type double patenting, so we affirm those rejections.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

Eric Grimes	)	
Administrative Patent Judge	)	
	)	BOARD OF PATENT
	)	
	)	APPEALS AND
	)	
Richard M. Lebovitz	)	INTERFERENCES
Administrative Patent Judge	)	
	)	

ADAMS, Administrative Patent Judge, concurring.

I join with the majority's decision to affirm the rejection of all claims on appeal under the judicially created doctrine of obviousness-type double patenting. However, for the following reasons, I disagree with the majority's decision to reverse the rejection under 35 U.S.C. § 103(a).

Obviousness is determined in terms of the level of skill of a person having ordinary skill in the art at the time the invention was made. 35 U.S.C. § 103; Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966). "A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 783, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993) (quoting In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976)). This so called "suggestion test" is not a rigid, inflexible test. To the contrary, the suggestion test is flexible and requires that the evidence be viewed through the lens of a person of ordinary skill in the art<sup>6</sup> with consideration of common knowledge and common sense. Dystar Textilfarben GMBH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1367, 80 USPQ2d 1641, 1650 (Fed. Cir. 2006).

As discussed in more detail below, on this record one need only read the evidence as would a person of ordinary skill in the art. It begins with a teaching in the art of two bone repair compositions that share a common core of ingredients and differ

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<sup>6</sup> "[T]he level of skill in the art is a prism or lens through which a judge, jury, or the Board views the prior art and the claimed invention. This reference point prevents these factfinders from using their own insight or, worse yet, hindsight, to gauge obviousness." Okajima v. Bourdeau, 261 F.3d 1350, 1355, 59 USPQ2d 1795, 1797 (Fed. Cir. 2001), citation omitted.

only with regard to the presence of demineralized bone in one (O'Leary), and calcium sulfate<sup>7</sup> (Yim) in the other. Adding to this body of evidence is a third reference (Wironen) which teaches a bone repair composition comprising demineralized bone and any one of a variety of reagents that "enhance the range of manipulative characteristics of strength and osteoinduction,"<sup>8</sup> e.g., the properties Yim attributes to calcium sulfate.<sup>9</sup> Both O'Leary (column 1, lines 15-17) and Yim (column 8, lines 25-28) compliment Wironen by teaching, inter alia, that demineralized bone and calcium sulfate aid in the development of new bone. In this regard, I note that Wironen teaches that it is desirable for a bone repair composition to be both osteoconductive and osteoinductive. The evidence of record establishes that a composition comprising demineralized bone and calcium sulfate fulfills this objective. Lastly, Wironen explains that when one intends to repair large bone voids it is a matter of common sense to add cancellous bone to a bone repair composition. Wironen, page 13, lines 11-14.

For their part, the majority is determined to find that the evidence of record in this case is not sufficient to support a prima facie case of obviousness. In their rush to reverse the rejection under 35 U.S.C. § 103(a), the majority speaks of the

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<sup>7</sup> Yim discloses the use of calcium sulfate hemihydrate. Appellants' claims 16 and 23 requires calcium sulfate. For clarity, I note that according to appellants' specification the calcium sulfate can be calcium sulfate hemihydrate. See, e.g., "Preferred Embodiment 6," appellants' specification, page 9. Therefore, all reference to calcium sulfate, herein, refers to both calcium sulfate and calcium sulfate hemihydrate.

<sup>8</sup> See Wironen, page 6, lines 8-9.

<sup>9</sup> Yim, column 8, lines 25-28, calcium sulfate provides, inter alia, "a structural matrix function [and] an osteoconductive matrix. . . ."

preponderance of the evidence<sup>10</sup>, yet they fail to consider all of the evidence of record, and what this evidence suggests to a person of ordinary skill in the art.

For the reasons that follow, it is my opinion that the evidence of record supports a prima facie case of obviousness under 35 U.S.C. § 103(a), and that this rejection should be affirmed. Accordingly, I dissent from the majority's decision to reverse the rejection under 35 U.S.C. § 103(a).

Appellants' claimed invention:

Appellants argue the claims according to two claim groupings: I. claims 16-22 and II. claims 23-30. Accordingly, I limit my discussion to representative claims 16 and 23. Claims 17-22 will stand or fall together with claim 16. Claims 24-30 will stand or fall together with claim 23. In re Young, 927 F.2d 588, 590, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991).

Claim 16 is drawn to a composition which comprises five components:

1. calcium sulfate;
2. demineralized bone matrix;
3. cancellous bone;
4. a plasticizing substance (e.g., hydroxypropyl methylcellulose<sup>11</sup>); and
5. a mixing solution<sup>12</sup>.

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<sup>10</sup> See, e.g., supra, page 12, wherein the majority finds the "preponderance of the evidence" fails to demonstrate "that the cited references would have suggested the instantly claimed composition to those of ordinary skill in the art."

<sup>11</sup> See appellants' specification, bridging sentence, pages 3-4.

<sup>12</sup> While the majority points out (supra, page 3), that appellants' specification states that a mixing solution may "include water and phosphate buffered saline," claims 16 and 23 are not so limited.

Claim 23 depends from and further limits the composition of claims 16 to comprise specified amounts of the five ingredients set forth in claim 16.

The prior art:

In setting forth the rejection of claims 16 and 23, the examiner relies on the combination of three references - O'Leary, Yim and Wironen.

O'Leary

O'Leary teaches a “flowable<sup>[13]</sup> demineralized bone powder composition . . . for use in surgical bone repair.” See, e.g., O'Leary, Abstract. In this regard, the examiner finds (Answer, page 5), O'Leary discloses that the composition comprises demineralized bone; a mixing solution; and hydroxypropyl methylcellulose (a plasticizing substance). According to O'Leary (column 1, lines 15-17), “[b]one powder [e.g. demineralized bone] contains one or more substances . . . which induce bone regeneration at the defect site.” Stated differently, bone powder aids in the development of new bone. In addition, O'Leary discloses that bone morphogenic proteins (BMPs) can be incorporated into the bone powder composition, or more specifically into the bone particles themselves. O'Leary, column 2, line 53 to column 3, line 5.<sup>14</sup>

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<sup>13</sup> According to O'Leary (column 3, lines 30-36), “[t]he term ‘flowable’ as used herein applies to compositions whose consistencies range from those which can be described as shape-sustaining but readily deformable, e.g., those which behave like putty, to those which are runny. Specific forms of flowable bone powder compositions include cakes, pastes, creams and fillers.”

<sup>14</sup> The majority agrees that O'Leary teaches a composition comprising demineralized bone, hydroxypropyl methylcellulose, a mixing solution and BMP. See, e.g. supra, page 7.

Therefore, O'Leary teaches a bone repair composition that comprises:

- (1) demineralized bone;
- (2) hydroxypropyl methylcellulose (a plasticizing substance); and
- (3) a mixing solution.

As the examiner recognizes (Answer, page 6), however, O'Leary does not teach that calcium sulfate or cancellous bone is included in the bone repair composition.

### Yim

According to the examiner (id.), Yim discloses bone repair compositions that are formulated for delivery of BMP. In this regard, the examiner finds (Answer, page 9), Yim's formulations "contain calcium sulfate, a mixing solution, and a plasticizing substance . . . ." More specifically, Yim discloses a bone repair composition that comprises:

- (1) calcium sulfate;
- (2) hydroxypropyl methylcellulose (a plasticizing substance<sup>15</sup>); and
- (3) a mixing solution.

Yim, column 7, lines 26-40 and column 8, lines 16-30.<sup>16</sup>

According to Yim (column 8, lines 25-28), in this formulation the calcium sulfate "provides a structural matrix function, an osteoconductive matrix, and a protein

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<sup>15</sup> Yim discloses that protein-sequestering agents include cellulosic materials such as hydroxypropyl-methylcellulose. Yim, column 7, lines 1-37.

<sup>16</sup> The majority agrees that Yim teaches a composition comprising calcium sulfate, hydroxypropyl methylcellulose, a mixing solution and BMP. See, e.g. supra, bridging paragraph, pages 7-8.

sequestering function.” Stated differently, calcium sulfate aids in the development of new bone.

Yim, however, does not teach a composition comprising demineralized bone and cancellous bone.

### Wironen

Wironen also teaches a bone repair composition comprising demineralized bone and cancellous bone. Wironen teaches (page 3, lines 14-16), it is desirable for a bone repair composition to be both “osteoconductive (i.e. it conducts bone cells into a region) and osteoinductive (i.e. stem cells are induced to differentiate into bone forming cells which begin production of new bone).” According to Wironen (page 2, lines 18-19), demineralized bone is osteoinductive having “the ability to induce the formation of bone even in non-osseous tissues within 4 weeks.”

Wironen discloses a composition that comprises, inter alia, three components:

- i. demineralized bone;
- ii. “bioactive glass ceramic, BIOGLASS<sup>®</sup>, bioactive ceramic, calcium phosphate ceramic, hydroxyapatite, hydroxyapatite carbonate, corraline hydroxyapatite, calcined bone, tricalcium phosphate, like material, or mixtures thereof;” and
- iii. “bone morphogenetic protein [(BMP)], TGF-beta, PDGF, or mixtures thereof, natural or recombinant.”

See, e.g., Wironen, bridging paragraph, pages 5-6. According to Wironen (page 6, lines 8-9, emphasis added), “[w]here present [the reagents of component] (ii) or like material is included to enhance the range of manipulable characteristics of strength and osteoinduction exhibited by the composition.”

In this regard, I note that Wironen discloses (bridging paragraph, pages 1-2, emphasis added), “[a]ll of the artificially produced bone-grafting materials available today fall in the osteoconductive category of grafts. Among these are Bioglass<sup>®</sup>, Norian<sup>®</sup>, Collagraft<sup>®</sup>, corraline hydroxyapatite, powdered hydroxyapatite, crystalline and amorphous hydroxyapatite (hydroxyl apatite), and a number of other products.” No doubt this listing is not exhaustive, and while not listed, the evidence of record clearly establishes calcium sulfate as a member of this genus of osteoconductive reagents useful in a bone repair composition. See, e.g., Yim, column 8, lines 25-28, calcium sulfate provides, inter alia, “a structural matrix function [and] an osteoconductive matrix. . . .”

In addition, Wironen explains that cancellous bone can be added to the bone repair composition comprising demineralized bone when large bone voids need repair. Wironen, page 13, lines 11-14.

The common ground:

Both O’Leary and Yim teach a composition for use in bone repair that comprises a common core of ingredients which comprise:

- (1) hydroxypropyl methylcellulose (a cellulose derivative); and
- (2) a mixing solution.

As discussed above, this is undisputed by the majority.

The differences:

The prior art of record does not teach a composition that combines both calcium sulfate, demineralized bone and cancellous bone together with a common core of ingredients that comprises hydroxypropyl methylcellulose and a mixing solution. Instead, O'Leary takes this common core of ingredients and adds demineralized bone; and Yim takes this common core of ingredients and adds calcium sulfate. For his part Wironen teaches a bone repair composition comprising a gelatin (which may be "thermally cross-linkable") demineralized bone, cancellous bone, BMP, and a reagent that "enhances the range of manipulable characteristics of strength and osteoinduction exhibited by the composition." Wironen, page 5, line 21 to page 6, line 9.

The level of skill in the art:

In the background section of their specification (pages 1-2), appellants discuss a number of prior art references that establish the state of this art, and level of skill in this art. For clarity, I direct attention to the following documents: Sottosanti<sup>17</sup>, Hanker<sup>18</sup> and Snyders<sup>19</sup>. Each of these patents issued prior to the filing date of appellants' application, each teach bone repair compositions<sup>20</sup>, each is discussed in appellants'

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<sup>17</sup> Sottosanti, U.S. Patent No. 5,366,507, issued November 22, 1994

<sup>18</sup> Hanker et al. (Hanker), U.S. Patent No. 4,619,655, issued October 28, 1986

<sup>19</sup> Snyders, U.S. Patent No. 5,425,769, issued June 20, 1995

<sup>20</sup> See Sottosanti, column 1, lines 6-13; Hanker, column 1, lines 12-13; and Snyders, column 1, lines 10-12.

specification, and each is of record in the instant application<sup>21</sup>. Therefore, each document informs this record as to what a person of ordinary skill in this art, specifically a person with experience in the formulation of bone repair compositions<sup>22</sup>, knew and understood at the time of appellants' claimed invention.

Each patent teaches a composition that comprises demineralized bone and calcium sulfate. See Sottosanti, column 2, lines 24-26 (“[t]he present invention also provides a novel composite graft material containing DFDBA<sup>23</sup> and calcium sulfate.”); Hanker, column 2, lines 24-25 (“demineralized freeze-dried bone can be mixed with the plaster<sup>24</sup> and calcium phosphate ceramic.”); and Snyders, column 3, lines 51-54 (“[y]et another object of the invention is to provide an osteogenic composite material<sup>[25]</sup> in the presence of [a] bone derived osteoinductive material, including demineralized bone matrix. . . .”).

Therefore, the combination of both calcium sulfate and demineralized bone in a single bone repair composition is not new to appellants' invention. To the contrary, for years prior to appellants' filing date, a person of ordinary skill in this art knew that the

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<sup>21</sup> See Form PTO-1449, received March 29, 2002 and included, as considered by the examiner, in the Office Action mailed July 2, 2002.

<sup>22</sup> There is no dispute on this record that a person of ordinary skill in this art is a person with experience in the formulation of bone graft compositions.

<sup>23</sup> Sottosanti defines DFDBA as “[d]emineralized, freeze-dried, allogenic bone. . . .” Sottosanti, column 1, lines 28-29.

<sup>24</sup> According to Hanker (column 1, lines 15-17), “Plaster of Paris (PP) or equivalent forms of calcium sulfate hemihydrate, [are] hereinafter referred to for convenience as ‘plaster’. . . .”

<sup>25</sup> Snyders' “osteogenic composite material” is a combination of collagen and plaster (e.g., calcium sulfate). Snyders, column 4, lines 1-5; and column 5, lines 42-43.

combination of calcium sulfate and demineralized bone in a single bone repair composition aided in bone healing.

According to Sottosanti (column 1, lines 28-33), demineralized bone “induces undifferentiated cells in the graft site to differentiate into osteoblasts and grow into new bone, while the graft material is resorbed by the host.” At column 4, lines 10-17, Sottosanti discloses that the

[i]nclusion of DFDBA in the composite graft material actually induces new bone formation by stimulating cellular transformation. At the same time, the calcium sulfate in the graft material composition provides the benefit of enhanced binding of the DFDBA to an osseous recipient graft site and enhanced mineralization by providing a ready source of calcium ions.

Snyders discloses that “[f]or many years, it has been known that bone contains biochemical factors which are released and/or activated in response to bone injury . . . , and that these factors are essential not only in fracture repair but bone graft repair as well.” Snyders, column 6, lines 58-62. In addition, Snyders discloses that calcium sulfate “not only does not inhibit the normal growth and healing process of bone, it also has been characterized as an accelerant of the same because of its contribution of calcium ions to the process.” Snyders, column 4, lines 64-68. See also Hanker, column 1, lines 28-30, “[t]he [calcium sulfate] plaster also provides a source of calcium in the area of the implant and stimulates revascularization and bone formation; and Sottosanti (column 3, lines 10-12), “[t]he composite graft material [which contains calcium sulfate] also supplies a ready source of calcium for rapid mineralization.”

Therefore, at the time of appellants’ claimed invention, a person of ordinary skill in the art would have recognized, inter alia, that calcium sulfate provides a source of calcium ions that is important in bone healing, and that demineralized bone provides

important biochemical factors that are important in bone healing. As a result, those of ordinary skill in this art included both demineralized bone and calcium sulfate in a variety of bone repair compositions.

In my opinion, this is the knowledge and understanding a person of ordinary skill in the art would have as this person read the combination of references relied on by the examiner. More significantly, all of this is consistent with the teachings of O'Leary, Yim and Wironen as set forth above.<sup>26</sup>

The issue:

The issue before this panel can be divided into two parts. First, would it be prima facie obvious to a person of ordinary skill in the art at the time the invention was made to combine calcium sulfate and demineralized bone in a composition comprising a core of ingredients that is common to both O'Leary and Yim? Second, if the answer to the first part is yes, would it be prima facie obvious to a person of ordinary skill in the art at the time the invention was made to add cancellous bone to this composition?

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<sup>26</sup> The majority failed to address the level of skill in this art. Nevertheless, the majority opines that by discussing three of the documents cited in the background section of appellants' specification, I have modified the rejection of record. See supra n. 5. I disagree. The discussion of these documents simply emphasizes what appellants recognize as background information. The level of ordinary skill in the art, as exemplified by the evidence relied upon by the examiner, did not change simply because I discuss three documents relied upon by appellants to set the stage for their disclosure. The majority would have realized this had they considered the level of skill in this art. Since they did not, I do not find their comment persuasive.

In my opinion, when considered from the perspective of a person of ordinary skill in the art at the time the invention was made<sup>27</sup>, the evidence of record compels an affirmative response to both parts of the issue before us on appeal.

Analysis:

“A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.” Bell, 991 F.2d at 783, 26 USPQ2d at 1531. The evidence on this record teaches that the formulation of a bone repair composition that comprises both calcium sulfate and demineralized bone is not new to this art. As discussed above a person of ordinary skill in this art would be familiar with a variety of bone repair compositions comprising both demineralized bone and any one of a variety of reagents that enhance the range of manipulative characteristics of strength and osteoconduction, such as calcium sulfate. As discussed above, at the time of appellants’ invention, a person of ordinary skill in the art would have combined both calcium sulfate and demineralized bone in bone repair compositions to take advantage of their combined effect on bone healing. See, e.g., Sottosanti, column 4, lines 10-17; and Snyders, column 3, lines 51-54.

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<sup>27</sup> While the majority opines (supra, page 10) that “[d]etermining obviousness under § 103 is not a completely objective analysis,” I propose that “[i]nstead of ascertaining what was subjectively obvious to the inventor at the time of invention, [this panel] must ascertain what would have been objectively obvious to one of ordinary skill in the art at such time. Hence, the level of ordinary skill in the art is a factual question that must be resolved and considered.” Ryko Mfg. Co. v. Nu-Star, Inc., 950 F.2d 714, 718, 21 USPQ2d 1053, 1057 (Fed. Cir. 1991), footnote omitted.

Accordingly, the first part of the issue before this panel distills down to whether a person of ordinary skill in the art would have combined calcium sulfate and demineralized bone in a bone repair composition that comprises (1) hydroxypropyl methylcellulose (a cellulose derivative); and (2) a mixing solution.

As discussed above, both Yim and O'Leary teach bone repair compositions comprising hydroxypropyl methylcellulose and a mixing solution. It is true that neither of these references teach both calcium sulfate and demineralized bone in the same composition. However, Yim and O'Leary teach that calcium sulfate and demineralized bone, respectively, aid in bone healing when they are a part of a bone repair composition comprising hydroxypropyl methylcellulose and a mixing solution.

There can be no doubt that “[o]bviousness is a complicated subject requiring sophisticated analysis, and no single case lays out all facets of the legal test.” Dystar, 464 F.3d at 1367, 80 USPQ2d at 1650. Perhaps, what complicates this analysis is getting inside the mind of a person of ordinary skill in the art at the time the invention was made, to understand how this hypothetical person of ordinary skill in the art would read, process and combine the teachings of the prior art relied upon.<sup>28</sup> On this point, our appellate review court has provided guidance to assist the fact-finder in evaluating the prior art as a person of ordinary skill in the art and determining what this hypothetical person would glean from a full and fair reading of the prior art.

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<sup>28</sup> The issue of obviousness is not determined by what the references expressly state but by what they would reasonably suggest to one of ordinary skill in the art. In re Siebentritt, 372 F.2d 566, 568, 152 USPQ 618, 619 (CCPA 1967).

For example, our appellate reviewing court and its predecessor have explained that when the prior art recognizes two components to be equivalent, an express suggestion to substitute one for another need not be present in order to render such substitution obvious. In re Fout, 675 F.2d 297, 301, 213 USPQ 532, 536 (CCPA 1982).<sup>29</sup> In In re Kerkhoven, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980), the court stated that “[i]t is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose. In re Susi, 440 F.2d 442, 445, 169 USPQ 423, 426 (1971); In re Crockett, 279 F.2d 274, 276-77, 126 USPQ 186, 188 (1960).” As the Kerkhoven court explained “[i]n the case at bar, [the] appealed claims . . . require no more than the mixing together of two conventional spray-dried detergents.” Id.

There can be no doubt that each of these cases is dependent on its own facts.<sup>30</sup> However, each case exemplifies the flexibility implicit in a fact-based reasoned analysis of obviousness, and provides insight on what a person of ordinary skill in the art would glean from a full and fair reading of the prior art. As discussed above, on this record one need only read the evidence as would a person of ordinary skill in the art.

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<sup>29</sup> On this record, Wironen teaches a composition comprising cancellous bone, BMP and a reagent that “enhances the range of manipulable characteristics of strength and osteoinduction exhibited by the composition.” Wironen, page 5 line 21 to page 6, line 9. Yim discloses that calcium sulfate has both a structural matrix function and an osteoinductive function. Yim, column 8, lines 25-28. Accordingly, a person of ordinary skill in the art would have recognized that it would have been prima facie obvious at the time appellants’ invention to substitute calcium sulfate for any one of the reagents identified in Wironen that enhance the strength and osteoinduction of the bone repair composition.

<sup>30</sup> In re Cofer, 354 F.2d 664, 667, 148 USPQ 268, 271 (CCPA 1966) (“[n]ecessarily it is facts appearing in the record, rather than prior decisions in and of themselves, which must support the legal conclusion of obviousness under 35 U.S.C. § 103”).

On this record, O’Leary and Yim teach two bone repair compositions that share a common core of ingredients that comprise hydroxypropyl methylcellulose and a mixing solution. These two compositions differ only with regard to the presence of demineralized bone in one (O’Leary), and calcium sulfate in the other (Yim). Adding to this body of evidence is a third reference (Wironen) which expressly teaches the combination of demineralized bone together with any one of a variety of agents that “enhance the manipulable characteristics of strength and osteoinduction exhibited by the composition,” comprising demineralized bone and cancellous bone. While Wironen provides a listing of agents that fulfill this requirement, there can be no doubt that this listing is not exhaustive.<sup>31</sup> The evidence on this record, in addition to the knowledge of a person of ordinary skill in this art at the time the invention was made, establishes that calcium sulfate exhibits the same properties as those agents listed in Wironen. See, e.g., Yim, column 8, lines 25-28.

Therefore, in my opinion, it would have been prima facie obvious to a person of ordinary skill in the art at the time of appellants’ invention to combine calcium sulfate, and demineralized bone together with a common core of ingredients that comprises hydroxypropyl methylcellulose and a mixing solution to aid in bone healing. To do so would require nothing more than mixing two conventional bone repair compositions. Kerkhoven, 626 F.2d at 850, 205 USPQ at 1072.<sup>32</sup> As discussed above, this is exactly

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<sup>31</sup> See, e.g., Wironen, page 6, lines 1-3, where Wironen provides a listing of specific agents, in addition to, “like material[s]”.

<sup>32</sup> There is no doubt that neither Yim nor O’Leary speak to detergents (as in Kerkhoven), or reagents that stabilize plastics against the oxidative and deteriorative effects of ultraviolet light (as in Susi), or magnesium oxide and calcium carbide (as in Crockett) or amiloride and hydrochlorothiazide (as in Merck & Co. v. Biocraft Labs., Inc., 874 F.2d 804, 808-09, 10 USPQ2d 1843, 1847 (Fed. Cir. 1989)). What Yim

why people of ordinary skill in the art have combined both calcium sulfate and demineralized bone together in bone repair compositions for years prior to appellants' filing date. The combination of demineralized bone and calcium sulfate provides the properties that result in a desirable bone repair composition. See Wironen, page 3, lines 14-16, specifically, the resulting bone repair composition is both osteoconductive and osteoinductive.

The evidence on this record is consistent with the knowledge and understanding of a person of ordinary skill in the art. According to Yim (column 8, lines 25-28), the calcium sulfate component of the bone repair composition provides an osteoconductive functionality. Stated differently Yim teaches that the calcium sulfate component of a bone repair composition aids in the development of new bone. The evidence of record establishes that demineralized bone also has an osteoconductive functionality. O'Leary, column 1, lines 15-17, "[b]one powder contains one or more substances . . . which induce bone regeneration at the defect site." Stated differently, O'Leary teaches that the demineralized bone component of the bone repair composition aids in the development of new bone. See also, Wironen, page 2, lines 18-19.

In addition, Yim teaches that the calcium sulfate component of this composition provides a structural matrix and protein sequestering functionality. Yim, column 8, lines 25-28. Stated differently calcium sulfate acts as a scaffold and localizes BMP to the site of injury. O'Leary introduces BMP into the demineralized bone. O'Leary, column 2, line

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and O'Leary do speak to is a bone graft composition that uses calcium sulfate (Yim), or demineralized bone (O'Leary) to aid in bone healing. As discussed above, this is exactly why people of ordinary skill in the art have combined both calcium sulfate and demineralized bone together in bone repair compositions for years prior to appellants' filing date.

53 to column 3, line 5. While O'Leary does not characterize the demineralized bone as having a structural matrix or protein sequestering functionality, in my opinion a person of ordinary skill in the art would appreciate that demineralized bone provides these functionalities when BMP is introduced into the bone particles and thereby provides a scaffold, in addition to localizing BMP to the site of injury.

This is consistent with what a person of ordinary skill in this art knew and understood at the time of appellants' invention. See, e.g., Sottosanti, column 3, line 65 to column 4, line 2, "[t]he graft material is intended to function as a stimulus to bone tissue growth. It can . . . provide inducers of bone tissue growth, be a scaffolding-type structure that actively or passively attach osteoblasts or provide any combination of these functions." See also Snyders, column 3, lines 61-66, "[a]n object of the invention is manifested in a composition of osteogenic composite materials in combination with certain classes of biochemical agents having positive bone inductive effects to provide a physiologically enhanced scaffolding for bony healing and body contour restoration."

On reflection, the prior art of record teaches that calcium sulfate and demineralized bone have properties that aid in the healing and development of new bone. The prior art of record teaches the use of calcium sulfate or demineralized bone in a composition that comprises hydroxypropyl methylcellulose and a mixing solution. As discussed above, the evidence of record is consistent with what a person of ordinary skill in the art would have known and understood at the time of appellants' invention.

Therefore, when the evidence is considered as a whole, a person of ordinary skill in the art would have found it prima facie obvious at the time of appellants' claimed invention to include calcium sulfate in the bone repair composition taught by O'Leary,

which comprises demineralized bone, hydroxypropyl methylcellulose and a mixing solution.<sup>33</sup>

As to whether a person of ordinary skill in the art at the time the invention was made would have found it prima facie obvious to add cancellous bone to this composition, e.g., the second part of the issue before this panel for review, as Wironen explains, it is a matter of common sense to include cancellous bone in such a composition when one is intending to repair large voids.<sup>34</sup> Wironen, page 13, lines 11-14.

#### Claim 16

For the foregoing reasons, it is my opinion that the evidence on this record clearly establishes that at the time of appellants' invention a person of ordinary skill in the art interested in repairing a large bone void would have found it prima facie obvious to formulate a bone repair composition comprising calcium sulfate; demineralized bone matrix; cancellous bone; hydroxypropyl methylcellulose (a plasticizing substance); and a mixing solution.

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<sup>33</sup> The alternative combination wherein one includes demineralized bone in the bone graft composition taught by Yim, which comprises calcium sulfate, hydroxypropyl methylcellulose and a mixing solution results in the same conclusion.

<sup>34</sup> See, e.g., In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969) ("Having established that this knowledge was in the art, the examiner could then properly rely, . . . on a conclusion of obviousness 'from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference.' The test for obviousness is not whether the features of one reference may be bodily incorporated into the other to produce the claimed subject matter but simply what the combination of references makes obvious to one of ordinary skill in the pertinent art.").

For their part, appellants assert (Brief, page 4), “there is no motivation to combine the calcium sulfate hemihydrate of Yim with the teachings of O’Leary.” For the reasons set forth above the evidence of record does not support appellants’ assertion. According to appellants, “O’Leary suggests the use of a thickener if settling of the bone powder within the organic liquid is a problem . . . [suggesting] that the composition is intended to maintain a liquid, flowable state for an extended period of time.” Brief, page 5. Appellants assert (id.), “if the composition is intended to set into a hardened mass within a short period of time, settling would not be an issue.” From this, appellants conclude (id.), the “teachings of O’Leary are manifestly inconsistent with the well-known properties of calcium sulfate hemihydrate solutions . . . , [which] harden or set rather quickly as the calcium sulfate hemihydrate reacted with water to form the dehydrate form.”

I disagree with appellants’ unsupported assertion of the well-known property of calcium sulfate hemihydrate solutions, to harden quickly. Id. Contrary, to appellants’ assertion, a person of ordinary skill in the art would have recognized that compositions comprising calcium sulfate (including calcium sulfate hemihydrate) may be formulated into a putty, e.g., a semi solid. See, e.g., Hanker (column 2, lines 43-49), “[t]he implant composition [comprising calcium sulfate hemihydrate] . . . may be made up as a dry mix which can be moistened with water just prior to use to provide a fluid or semisolid, injectable formulation which can be injected into the appropriate body space as required for bone reconstruction.” See also, Yim, column 10, Table 2, wherein compositions comprising calcium sulfate are malleable at 15 minutes. Therefore, I am not persuaded by appellants’ unsupported assertion (Brief, page 5) that “the addition of calcium sulfate

hemihydrate to the O'Leary composition would have been avoided by one of skill in the art since the resulting composition would not have been expected to maintain a flowable state for an extended period of time. . . .”

Further, as I understand appellants' argument, since calcium sulfate allegedly quickly sets into a “hardened mass”<sup>35</sup>, a person of ordinary skill in the art would recognize that if calcium sulfate was added to O'Leary's composition there would be no reason to also include a thickener, or protein sequestering agent, such as hydroxypropyl methylcellulose. I disagree. Appellants' argument is inconsistent with the evidence of record, which teaches the inclusion of a thickener, or protein sequestering agent, such as hydroxypropyl methylcellulose in a bone repair composition comprising calcium sulfate. See Yim, column 8, lines 16-30. Accordingly, the argument is not persuasive.

In addition, I recognize appellants' reference to O'Leary's composition as maintaining a “flowable state” for an “extended period of time.” Brief, page 5. It would appear that appellants are suggesting that O'Leary's composition is intended to be in a “liquid” state for an extended period of time. In this regard, I note that appellants rely on Table 2, column 10 of Yim<sup>36</sup>, alleging that compositions comprising calcium sulfate were “non-flowable within 15 minutes.” Brief, page 5<sup>37</sup>. Appellants' assertions are not

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<sup>35</sup> See, e.g., Brief, page 5, where appellants assert “if the composition is intended to set into a hardened mass within a short period of time, settling would not be an issue.”

<sup>36</sup> I note that the data presented in Table 2 of Yim is directed to the ability of calcium sulfate to improve the handling characteristics of a composition such as that taught by U.S. Pat. No. 5, 171,579 (e.g., a composition comprising blood). While this is one embodiment of Yim's disclosure, as discussed above, the bone graft composition disclosed by Yim at column 8, lines 16-28 does not contain blood.

<sup>37</sup> At page 5 of the Brief appellants assert “Yim itself describes how quickly a calcium sulfate hemihydrate solution loses flowability in Table 2 in column 10. Note that each tested composition appearing in Table 2 was non-flowable within 15 minutes.”

consistent with the evidence of record. First, O'Leary's compositions are not limited to a liquid state. As discussed above, O'Leary defines flowable as including compositions that are "shape-sustaining", "e.g., those which behave like putty." O'Leary, column 3, lines 30-36. Further contrary to appellants' suggestion, Table 2 of Yim is consistent with O'Leary's "shape-sustaining but readily deformable"<sup>38</sup> composition, for Table 2 of Yim describes compositions that are "shapable", "remoldable" and "malleable" after 15 minutes. Yim, column 10, Table 2, Key #5. Accordingly, I am not persuaded by appellants' argument.

Furthermore, nothing in appellants' claim 16 requires that the claimed composition exhibit a particular physical state (e.g., runny, moldable or hard), nor does appellants' claim 16 require a particular "set-up" time (e.g., slow, fast or within 15 minutes). In my opinion, appellants' arguments relating to the physical state or set-up time of the composition are not commensurate in scope with their claimed invention.

For these same reasons, I am not persuaded by appellants' assertion (Brief, page 6) that they "have discovered that the claimed plasticizing substance [e.g., hydroxypropyl methylcellulose] can forestall the calcium sulfate hemihydrate hardening reaction, [and that] this effect is not appreciated in the prior art." As discussed above, the combination of prior art relied upon by the examiner teaches a bone repair composition that comprises, inter alia, a "plasticizing substance" – hydroxypropyl methylcellulose. Appellants' claim 16 does not require that the composition exhibit any particular form or characteristic, such as an extended "set-up" time. While there is no doubt that the claims shall be read in light of the specification (see, e.g., In re Morris,

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<sup>38</sup> O'Leary, column 3, lines 30-36.

127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997)), I find no requirement in the law that requires limitations of appellants' specification to be read into the claim.

Further, relying on Baillie<sup>39</sup> as an evidentiary document the examiner points out (Answer, page 16) that prior to appellants' filing date cellulose derivatives were known in the art as set retardants for calcium sulfate. Stated differently, appellants have not discovered, but instead have realized what was known to a person of ordinary skill in the art for more than 30 years prior to their filing date. I am not persuaded by appellants' argument that Baillie "is directed to wall plasters and does not represent art that would be considered by one of ordinary skill in the field of bone . . . [repair] compositions." Reply Brief, page 4. In my opinion, the question is what a person of ordinary skill in the art knew about calcium sulfate and its combination with cellulose derivatives. Baillie clearly informs a person of ordinary skill in the art using calcium sulfate that cellulose derivatives are known as set retardants for calcium sulfate.<sup>40</sup> Accordingly, I am not persuaded by appellants' argument.

I am also not persuaded by appellants' assertion (Brief, page 8), "there is no motivation to combine the teachings of the Wironen reference with the teachings of either O'Leary or Yim." In this regard, appellants point out that Wironen "describes a

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<sup>39</sup> Baillie et al. (Baillie), GB 999,487, published July 28, 1965

<sup>40</sup> In this regard, I direct attention to Snyders (column 2, lines 21-38), who provides evidence that a person of ordinary skill in this art would have known that calcium sulfate hemihydrate "is quite similar to plasters used in the building trade."

bone paste that contains thermally crosslinkable gelatin<sup>[41]</sup> as the carrier for one or more osteogenic components.” Id. According to appellants (Brief, page 9), Wironen “specifically contrasts the teachings therein with a commercialized embodiment [(GRAFTON)] of the formulation described in the O’Leary reference.” However, upon closer inspection of Wironen, I find that the reference discloses (page 3, lines 22-26):

one commercially available product, GRAFTON<sup>®</sup>, (see U.S. Patent No. 5,484,601) is a non-cross-linkable composition of demineralized bone powder suspended in a polyhydroxy compound (e.g. glycerol) or esters thereof, optionally including various other ingredients, including gelatin. It is considered likely that this material is rapidly washed away from the implant location as the carrier matrix is glycerol, which is water soluble.

As I understand appellants’ argument, Wironen recognizes a “disadvantage” of one embodiment of O’Leary. I note, however, that “[a]ll the disclosures in a reference must be evaluated . . . a reference is not limited to the disclosure of specific working examples.” In re Mills, 470 F.2d 649, 651, 176 USPQ 196, 198 (CCPA 1972). In this regard, I note that O’Leary does teach that glycerol, as well as a number of other agents, may be used as a carrier. See, e.g., O’Leary, column 3, lines 36-55. Further, O’Leary recognizes the problem noted by Wironen when glycerol is used as the carrier. See O’Leary, column 3, line 63 – column 4, line 7, emphasis added,

where [for example] the carrier component is glycerol and separation of bone powder occurs to an excessive extent where a particular application is concerned, a thickener such as . . . hydroxypropyl methylcellulose . . . can be combined with the carrier in an amount sufficient to significantly improve the suspension-keeping characteristics of the composition.

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<sup>41</sup> Thermally cross-linkable gelatin is a preferred embodiment of Wironen’s disclosure. See, e.g., page 7, lines 16-25, “[t]he composition of this invention comprises gelatin. . . . The gelatin is preferably thermally cross-linkable. . . .” In this regard, I remind appellants that a reference is not limited to its preferred embodiments.

Therefore, as I understand O'Leary, when the solution is such that the demineralized bone cannot be properly sequestered for a particular surgical application, a thickening agent (or protein-sequestering agent) should be included in the composition. One such thickening agent, or protein-sequestering agent, taught by O'Leary is hydroxypropyl methylcellulose. Apparently recognizing the same problem with their composition, Yim teaches the use of hydroxypropyl methylcellulose, as well as calcium sulfate, as a protein-sequestering agent. Yim, column 7, lines 26-37, 50-54 and column 8, lines 25-30. Based on the foregoing analysis, it would appear that the combination of O'Leary and Yim, would overcome the disadvantage Wironen attributes to the O'Leary composition. Accordingly, I am not persuaded by appellants' argument.

On reflection, it is my opinion that the evidence of record supports the examiner's conclusion that a bone repair composition comprising calcium sulfate; demineralized bone matrix; cancellous bone; hydroxypropyl methylcellulose; and a mixing solution would have been prima facie obvious to a person of ordinary skill in the art at the time the invention was made. As discussed above, appellants' arguments to the contrary are insufficient to rebut this prima facie case of obviousness. Accordingly, I would affirm the rejection of claim 16 under 35 U.S.C. § 103 as being unpatentable over the combination of O'Leary, Yim and Wironen. As discussed above, claims 17-22 fall together with claim 16.

#### Claim 23

As discussed above, claim 23 depends from and further limits the composition of claim 16 to require specified concentrations of ingredients. Appellants provide no

argument with regard to the teachings of the combination of O'Leary, Yim and Wironen as it relates to the concentrations of calcium sulfate, demineralized bone matrix, plasticizing substance or mixing solution as set forth in claim 23. Accordingly, I find that appellants concede that the combination of O'Leary, Yim and Wironen teach concentrations that fall within the scope of appellants' claimed invention for these ingredients.

Appellants' only argument with regard to claim 23 is that Wironen "is completely silent as to any particular weight percent or parts by weight of cancellous bone." Brief, page 10. In response, the examiner finds (Answer, page 23), Wironen teaches that cancellous bone is included in the composition to fill larger bone voids. As I understand the examiner's argument (id.), depending on the particular void that requires filled, the optimization of the particular amount of cancellous bone to fill a particular void is well within the skill of the practitioner. In the examiner's opinion (id.), "[i]t remains unclear as to how the practitioner would not be able to determine the size of the void to be filled and add as much cancellous bone as deemed necessary to fill the void." I agree. In the absence of evidence to the contrary, of which there is none, "it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Therefore, I disagree with appellants' intimation that "[t]his is not a question of optimization within a range taught in the prior art reference because there is no range whatsoever in the prior art reference relied upon by the [e]xaminer." Reply Brief, page 4. To the contrary, in my opinion this is a question of optimizing a results effective variable. The prior art relied upon expressly states that the purpose of the cancellous

bone chips in the composition is to fill large voids in bone. See, e.g., Wironen, page 13, lines 11-14. It would appear to be quite rational that one looking at a large void in a bone, would select the appropriate size and quantity of bone chips to fill the void. In my opinion, the prior art did not recite a particular concentration of bone chips because it would appear that a person of ordinary skill in the art would understand that it would depend on the size of the void to be filled. “[T]he test of obviousness is not express suggestion of the claimed invention in any or all of the references but rather what the references taken collectively would suggest to those of ordinary skill in the art presumed to be familiar with them.” In re Rosselet, 347 F.2d 847, 851, 146 USPQ 183, 186 (CCPA 1965). Accordingly, I do not find appellants’ argument persuasive.

For the foregoing reasons, I would affirm the rejection of claim 23 under 35 U.S.C. § 103(a) as being unpatentable over the combination of O’Leary, Yim and Wironen. As discussed supra claims 24-30 fall together with claim 23.

Majority opinion:

Rigidly applying the suggestion test and failing to consider all the evidence of record, the majority concludes (Supra, page 9), “[t]he examiner has not adequately explained how the prior art would have suggested modifying O’Leary’s composition by adding calcium sulfate to it.<sup>[42]</sup> Nor has the examiner provided a rationale based on the knowledge of those of skill in the art or the nature of the problem to be solved.”

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<sup>42</sup> While the majority recognizes (supra, bridging sentence, pages 7), “Yim’s compositions have two required components: calcium sulfate hemihydrate-containing substance (CSHS) and an osteogenic protein [(BMP)]”, the majority ignores Yim’s disclosure that in this embodiment “CSHS provides a structural matrix function, an osteoconductive matrix, and a protein sequestering function.” Yim, column 8, lines 25-28. As the subject matter before this panel is directed to a bone graft composition it

As I understand it, the majority's concern is one of motivation, or the suggestion to combine the references of record. The majority, however, limits their review of Yim and O'Leary, and looking solely to the references themselves concludes that the references themselves fail to provide a suggestion for their combination. See, e.g., supra, bridging paragraph, pages 9, "O'Leary does not disclose that its composition is in need of improved handling properties, such that those skilled in the art would have been led to modify it as taught by Yim." In this regard, I remind the majority that all the evidence of record must be considered for what it suggests to a person of ordinary skill in the art.<sup>43</sup> Further, "there is no requirement [under 35 U.S.C. § 103] that the prior art contain an express suggestion to combine known elements to achieve the claimed invention. Rather, the suggestion to combine may come from the prior art, as filtered through the knowledge of one skilled in the art." Motorola, Inc. v. Interdigital Tech. Corp., 121 F.3d 1461, 1472, 43 USPQ2d 1481, 1489 (Fed. Cir. 1997).

That said, I note that when the evidence on this record is considered as a whole, it establishes that a person of ordinary skill in the art at the time the invention was made would have known of a variety of bone repair compositions that utilize both calcium sulfate and demineralized bone for the purpose of aiding in healing bone. Accordingly, I disagree with the majority's intimation that the evidence of record fails to motivate

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would appear, at a minimum, that the osteoconductive matrix function of CSHS would be relevant to the majority's analysis of the evidence of record. Unfortunately, the majority either overlooked this teaching in Yim, or was of the opinion that Yim is solely directed to improving the handling characteristics of a bone graft composition that comprises blood. See, e.g., supra, page 8, wherein the majority finds that Yim teaches that the inclusion of CSHS improves the handling characteristics of a formulation comprising blood.

<sup>43</sup> "[A]ll of the relevant teachings of the cited references must be considered in determining what they fairly teach to one having ordinary skill in the art." In re Mercier, 515 F.2d 1161, 1165, 185 USPQ 774, 778 (CCPA 1975).

a person of ordinary skill in this art to combine calcium sulfate with demineralized bone in a composition comprising hydroxypropyl methylcellulose and a mixing solution as taught by both O'Leary and Yim.

I also disagree with the majority's assertion that "without the benefit of hindsight, the references would not have suggested modifying the prior art compositions in a way that would produce the composition claimed here" because "[e]ach of the prior art compositions is disclosed as a complete bone . . . [repair] composition having bone growth promoting properties. . . ." Supra, page 11, emphasis added. Contrary to the majority's assertions it is not hindsight to combine the teachings of prior art references where the references themselves, in addition to the knowledge and common sense of a person of ordinary skill in the art suggest they be combined.<sup>44</sup> Despite the majority's assertion to the contrary (supra, page 11<sup>45</sup>), this is true even when each prior art reference teaches a "complete invention". Contrary to the majority's assertion, while a person of ordinary skill in the art may build upon prior accomplishments, and modify the prior art to improve on what has come before, it does not necessarily follow under our law that any such modification of the prior art is a nonobvious modification. See, e.g., Pro-Mold & Tool Co., Inc. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573 (Fed. Cir. 1996) ("[w]e start from the self-evident proposition that mankind, in particular, inventors, strive to improve that which already exists".) As the court in Dystar explains

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<sup>44</sup> See, e.g., In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969).

<sup>45</sup> According to the majority (supra, page 11, emphasis added), it is only with the benefit of hindsight that the references could be combined, because "[e]ach of the prior art compositions is disclosed as a complete bone graft substitute composition having bone growth promoting properties."

[b]ecause the desire to enhance commercial opportunities by improving a product or process is universal – and even commonsensical – we have held that there exists in these situations a motivation to combine prior art references even absent any hint of suggestion in the references themselves. In such situations, the proper question is whether the ordinary artisan possesses knowledge and skills rendering him capable of combining the prior art references.

Dystar, 464 F.3d at 1368, 80 USPQ2d at 1651.

While the majority is satisfied to simply assert that “the cited references would [not] have suggested the instantly claimed composition to those of ordinary skill in the art,” the majority makes no attempt to consider all the teachings of the prior art on this record, or what the level of skill in the art was at the time of appellants’ claimed invention. I do not find it sufficient to simply proclaim that a fact-based reasoned analysis of the evidence on this record is based on hindsight reconstruction and then stick your head in the sand to avoid any consideration of all the evidence of record, and what a person of ordinary skill in the this art knew and understood at the time appellants’ invention was made. Unlike anticipation, where all the elements of a claimed invention are to be found in a single prior art reference<sup>46</sup>, the issue before this panel is obviousness. An obviousness analysis requires that the evidence be considered through the lens of a person of ordinary skill in the art.<sup>47</sup>

Contrary to the majority’s intimation, this is not a case where a person of ordinary skill in the art is imbued with the knowledge of appellants’ invention where none of the

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<sup>46</sup> “Under 35 U.S.C. § 102, every limitation of a claim must identically appear in a single prior art reference for it to anticipate the claim.” Gechter v. Davidson, 116 F.3d 1454, 1457, 43 USPQ2d 1030, 1032 (Fed. Cir. 1997).

<sup>47</sup> Obviousness is determined in terms of the level of skill of a person having ordinary skill in the art at the time the invention was made. 35 U.S.C. § 103; Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966).

references of record convey that knowledge. Cf. W.L. Gore & Assoc., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983). To the contrary, as discussed above, the evidence of record in this case clearly suggests that demineralized bone and calcium sulfate have bone healing properties and that a person of ordinary skill in the art would have found it prima facie obvious to combine them together with hydroxypropyl methylcellulose and a mixing solution in the same bone repair composition. Adding cancellous bone to this composition to fill large bone voids is simply a matter of common sense. The level of skill in this art is consistent with, and complementary to this analysis of the evidence on this record.

For the foregoing reasons, I find that the preponderance of the evidence on this record clearly establishes that appellants' claimed invention would have been prima facie obvious to a person of ordinary skill in the art at the time the invention was made in view of the combination of O'Leary, Yim and Wironen. In my opinion, the majority's assertion that the combination of O'Leary, Yim and Wironen is based on hindsight reconstruction is inconsistent with the evidence on this record.

Conclusion:

On reflection, I find no error in the examiner's rejection of under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of O'Leary, Yim and Wironen. Accordingly, I would affirm the rejection of claims 16 and 23 under 35 U.S.C. § 103(a). As set forth above, claims 17-22 and 24-30 fall together with claims 16 and 23 respectively.

While the foregoing analysis may be different from that set forth in the Answer, I note that appeal to the Board is from a decision of the examiner, not from the reasons upon which such decision is based. Ex parte Maas, 9 USPQ2d 1746, 1748 (BPAI 1987). Nevertheless, since the rationale differs from that of the examiner, appellants should be provided with a fair and full opportunity to respond. Therefore, the affirmance should be designated as a new ground of rejection under 37 C.F.R. § 41.50(b), and appellants provided with an appropriate time period to respond according to the Rule.

Donald E. Adams  
Administrative Patent Judge

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