United States Court of Appeals for the Federal Circuit

THE BOARD OF TRUSTEES OF THE LELAND STANFORD JUNIOR UNIVERSITY,
Plaintiff-Appellant

v.

THE CHINESE UNIVERSITY OF HONG KONG,
Defendant-Appellee

2015-2011

Appeal from the United States District Court for the Northern District of California in No. 3:12-cv-00865-SI, Judge Susan Y. Illston.

Decided: June 27, 2017

EDWARD R. REINES, Weil, Gotshal & Manges LLP, Redwood Shores, CA, argued for plaintiff-appellant. Also represented by DEREK C. WALTER, MICHELE GAUGER.

CHARLES E. LIPSEY, Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, Reston, VA, argued for defendant-appellee. Also represented by STEVEN O'CONNOR; JENNIFER SWAN, ROBERT F. MCCAULEY, JEFFREY DANIEL SMYTH, LILY LIM, Palo Alto, CA; HOWARD WARREN LEVINE, Washington, DC.

Before O'MALLEY, REYNA, and CHEN, *Circuit Judges.*

O'MALLEY, *Circuit Judge.*

The Board of Trustees of the Leland Stanford Junior University ("Stanford") appeals from orders of the Patent Trial and Appeal Board ("Board") in three interference proceedings between Stanford and the Chinese University of Hong Kong ("CUHK"). In all of these proceedings, the Board found that Stanford's claims were unpatentable for lack of written description. *See Quake v. Lo*, No. 105,920 (P.T.A.B. Apr. 7, 2014); *Lo v. Quake*, No. 105,923 (P.T.A.B. Apr. 7, 2014); *Lo v. Quake*, No. 105,924 (P.T.A.B. Apr. 7, 2014).[1] Because we conclude that the Board relied on improper evidence to support its key findings and did not cite to other substantial evidence to support its findings, we vacate the Board's interference decisions and remand for further proceedings.

I. BACKGROUND

A. Technology and Patents

This appeal concerns testing methods for fetal aneuploidies, conditions in which a fetus either has an abnormally high number of chromosomes (e.g., Down's

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[1] Although Stanford has appealed the Board's decision in all three of these interferences, the Board's orders in interferences 105,923 and 105,924, relating to Quake's application 12/393,833, contain largely the same findings as those issued by the Board in interference 105,920, between CUHK professor Dennis Lo's application 13/070,275 and Stanford professor Stephen Quake's U.S. Patent No. 8,008,018 ("the '018 patent"). We therefore cite to the '920 interference in this decision for clarity, but our decision applies to the Board's findings in all three interferences.

syndrome, a result of trisomy 21) or an abnormally low number of chromosomes (e.g., Turner's syndrome, a result of a missing copy of an X chromosome). Prior to the methods developed by the inventors involved in this appeal, physicians typically diagnosed fetal aneuploidies using invasive amniocentesis or chorionic villus sampling procedures. Doctors used less invasive testing methods for identifying aneuploidies, such as ultrasonography and biochemical marker detection, but these methods had suboptimal diagnostic accuracy.

The two competing inventors in the underlying interferences on appeal—Stanford professor Stephen Quake and CUHK professor Dennis Lo—both developed methods for diagnosing aneuploidies using cell-free fetal DNA ("cff-DNA") from maternal blood samples. In 1997, Lo and a colleague discovered that cff-DNA circulates in maternal blood in small amounts. This discovery made possible new prenatal screening techniques for chromosomal and other abnormalities, but researchers developing techniques for assaying cff-DNA had to overcome interference from maternal DNA in the maternal blood sample.

In 2006, Quake developed a "digital analysis" method to detect small changes in the quantity of an aneuploid chromosome relative to the quantity of one or more normal chromosomes, without distinguishing between maternal and fetal DNA. '018 patent, col. 1, ll. 46–60; col. 2, ll. 7–9; col. 7, ll. 46–61. Quake describes "a method of differential detection of target sequences in a mixture of maternal and fetal genetic material." *Id.* col. 4, ll. 43–45. The '018 specification explains that the approach "involves the separation of the extracted genomic material into discrete units so that the detection of a target sequence (e.g., chromosome 21) may be simply quantified as binary (0, 1) or simple multiples, 2, 3, etc." *Id.* col. 1, ll. 49–52.

Quake's specification outlines the four steps in his method: (1) obtaining a maternal tissue sample, preferably blood; (2) distributing single DNA molecules from this sample to a number of discrete reaction samples; (3) "[d]etecting the presence of the target in the DNA in a large number of reaction samples"; and (4) performing "[q]uantitative analysis of the detection of the maternal and fetal target sequences." *Id.* col. 8, l. 35–col. 9, l. 6. The method requires a large number of samples, as only a small amount of cff-DNA is present in a maternal sample. The specification clarifies that the digital PCR technique, in which a known target DNA sequence in a reaction well is amplified by target-specific primers, is the preferred embodiment for amplifying and detecting target sequences.

The capabilities of second-generation massively parallel sequencing ("MPS") are useful for performing Quake's method, as this method can process large numbers of DNA samples simultaneously. Quake's specification discloses that second-generation MPS can be used for counting chromosomes through DNA sequencing using the Illumina sequencing platform. *Id*, col. 19, l. 59–col. 20, l. 3. MPS can be performed by "random" or "targeted" methods. In the random format, all DNA in a sample is linked to a leader sequence and amplified using a primer complementary to the leader. Appellee Br. 10. In the targeted format, the target sequence is specifically amplified, and then sequenced.

Quake claimed his method in an application filed on February 2, 2007; this application issued as U.S. Patent No. 7,888,017 ("the '017 patent"). Quake filed continuation application no. 12/393,803 ("the '803 application") in February 2009. This continuation application issued as the '018 patent at issue in this appeal. The '017 and '018 patents share the same specification.

The original claims of Quake's '803 application explicitly recited methods that required the detection of "target sequences." For example, claim 1 of the '803 application read:

> 1. A method of differential detection of *target sequences* in a mixture of maternal and fetal genetic material, comprising the steps of:
>
> a) obtaining maternal tissue containing both maternal and fetal genetic material;
>
> b) distributing the genetic material into discrete samples, each sample containing on average not more than about one target sequence per sample;
>
> c) measuring the presence of *different target sequences* in the discrete samples; and
>
> d) analyzing a number of the discrete samples sufficient to obtain results distinguishing different *target sequences*.

J.A. 3253 (emphasis added).

In 2011, Quake cancelled all pending claims in the application which later issued as the '018 patent, and added new claims.[2] A representative later-added claim from the '018 patent states:

> 1. A method for determining presence or absence of fetal aneuploidy in a maternal tissue sample comprising fetal and maternal genomic DNA, wherein the method comprises:

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[2] Quake filed other applications on the same subject, including the 12/393,833 application at issue in the '923 and '924 interferences.

> a. obtaining a mixture of fetal and maternal genomic DNA from said maternal tissue sample;
>
> b. conducting massively parallel DNA sequencing of DNA fragments *randomly selected* from the mixture of fetal and maternal genomic DNA of step a) to determine the sequence of said DNA fragments;
>
> c. identifying chromosomes to which the sequences obtained in step b) belong;
>
> d. using the data of step c) to compare an amount Stanfordof at least one first chromosome in said mixture of maternal and fetal genomic DNA to an amount of at least one second chromosome in said mixture of maternal and fetal genomic DNA, wherein said at least one first chromosome is presumed to be euploid in the fetus, wherein said at least one second chromosome is suspected to be aneuploid in the fetus, thereby determining the presence or absence of said fetal aneuploidy.

'018 patent, col. 33, ll. 48–67 (emphasis added).

Lo's "random sequencing" method uses random MPS and does not require the detection of specific target sequences. The first step of Lo's method is to obtain a maternal blood sample, containing both maternal and cff-DNA. The researcher then sequences the mixed maternal and cff-DNA from the blood sample using random MPS. The sequence fragments obtained from random MPS are then aligned to a reference genome to determine a chromosome or chromosomal region of origin for each sequence. Once the chromosome fragments have been mapped to their respective chromosomes of origin, the

researcher can compare the overall number of sequences mapped to each chromosome. A disproportionate number (e.g., greater frequency) of aligned sequences to chromosome 21 reveals the presence of a Down's syndrome trisomy.

Lo filed provisional application no. 60/951,438 describing the "random sequencing" method on July 23, 2007, and subsequently filed application no. 12/178,181 on July 23, 2008. This application published in January 2009.

B. Interference History

CUHK claims that, in 2011, Quake realized that CUHK had claimed the "random sequencing" method. Quake then cancelled all pending claims in the application that later issued as the '018 patent, and added the claims listed above that, for the first time, explicitly cover random MPS methods. CUHK also claims that the '833 application copied claims from Lo. Stanford contends that random MPS is disclosed in the specification and supports these later-filed claims.

Both Quake and Lo requested interferences to determine who invented the random sequencing method, and when the method was invented. In early 2013, the PTO declared three interferences between Quake's patents and applications and Lo's patents and applications.[3] In each proceeding, Lo attacked the Quake '018 patent or the '833 application as unpatentable for lack of written description. Supported by expert testimony from Dr. Stacey Gabriel, CUHK claimed that Quake's specification de-

[3] The '920 interference involved Lo application no. 13/070,275 and the '018 patent. The '923 interference involved Lo applications nos. 12/178,181, 13/070,240, 12/614,350, and 13/070,251 and Quake's '833 application. The '924 interference involved Lo application no. 13/417,119 and Quake's '833 application.

scribes the digital analysis of predetermined target sequences and is inconsistent with the random sequencing method invented by Lo. Supported by expert testimony from Dr. John Detter, Stanford claimed that Quake's specification clearly contemplated random MPS. Relying primarily on the language of columns 19–20 of the '018 patent, Stanford argued the '018 patent discloses every aspect needed to detect aneuploidy using random MPS including random sequencing, step (b) of the claim; alignment, step (c) of the claim; and a comparison step, step (d) of the claim.

The Board granted CUHK's written description motion in all three interferences and found Quake's claims were unpatentable. J.A. 23; J.A. 52; J.A. 81. The Board found that the specification disclosed "targeted" rather than "random" sequencing, and the specification would not have indicated to one of ordinary skill in the art that Quake was in possession of the claimed random MPS method. J.A. 22.

In its decision, the Board repeatedly credited the testimony of Dr. Gabriel, including in finding that (1) the specification of the '018 patent is directed to the use of "digital analysis" of predetermined targeted sequences in a sample, and (2) the language relied upon by Quake could have related to either random or targeted sequencing but that, because "the main focus of the Quake '018 patent [was] on diagnosing aneuploidy with digital PCR, those of skill in the art would have understood the discussion of massively parallel sequencing to refer to sequencing targeted, predetermined portions of the DNA in a sample, not sequencing of random DNA." J.A. 8–12; J.A. 20.

The Board also rejected "Quake's characterization of Dr. Gabriel's testimony. Though Dr. Gabriel testified that the Quake specification discloses massively parallel sequencing, we do not find that she testified the applica-

tion discloses massively parallel sequencing of *random* DNA fragments." J.A. 17 (emphasis in original). The Board concluded that Dr. Gabriel's statement that the Illumina platform referenced in the specification could be used for both random and targeted sequencing was not a reference to random MPS, as used by Lo. According to the Board, this reference to the Illumina platform could have also supported targeted sequencing and, in the context of the entirety of the specification, did in fact refer to the targeted sequencing of DNA. J.A. 17–18.

Stanford argued that the references to "massively parallel sequencing of millions of fragments using attachment of randomly fragmented genomic DNA," "random sequence information," "identify[ing] a sequence as belonging to a specific human chromosome," and "software methods that can be used to identify a sequence in comparison to the known genome sequence," were all indicative of the random method for carrying out MPS. J.A. 11; J.A. 14–16. But the Board concluded that:

> Though the Quake inventors may have possessed parts of such a method, including massively parallel sequencing, randomly fragmenting DNA, and aligning sequences to genomic sequences, the facts do not indicate that those of ordinary skill in the art would have understood the inventors had put these pieces together into a complete method of sequencing random DNA fragments and identifying the sequenced fragments to determine aneuploidy.

J.A. 22.

C. District Court Proceedings

Stanford appealed the Board's interference rulings to the Northern District of California, pursuant to 35 U.S.C. § 146. Prior to the transfer of that appeal to this court, the parties engaged in discovery, including full expert

discovery, and CUHK filed a motion for summary judgment seeking resolution of the interferences in its favor as a matter of law. The district court conducted a hearing on CUHK's motion and thereafter denied CUHK's request, concluding that there were material issues of fact not suitable for resolution on summary judgment. Two days after the district court held the summary judgment hearing, CUHK notified the district court of a potential jurisdictional issue regarding § 146 in a District of Massachusetts case, *Biogen Idec MA, Inc. v. Japanese Foundation for Cancer Research*, 38 F. Supp. 3d 162 (D. Mass. 2014). The district court in *Biogen* held that the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), permitted the appeal of a Board interference decision only to the Federal Circuit for interferences declared after September 15, 2012. 38 F. Supp. 3d at 168. Pending the Federal Circuit's review in *Biogen*, the Northern District of California stayed the § 146 action.

On May 7, 2015, we affirmed the lower court's decision. *Biogen MA, Inc. v. Japanese Found. for Cancer Research*, 785 F.3d 648 (Fed. Cir. 2015). After we denied rehearing, the parties in this case jointly requested transfer of this case from the Northern District of California to the Federal Circuit. The district court granted the request and transferred the case here.

II. DISCUSSION

On appeal, Stanford briefs three questions. First, though it consented to the transfer of its appeals to this court, it asks that we rethink our decision in *Biogen* regarding the continued right to seek relief in district court after an unfavorable interference proceeding before the Board. Second, Stanford contends that, even if it cannot return to district court to complete the proceedings begun there, we should either take into consideration the record developed in that proceeding in reaching our

decision or vacate the Board's orders and instruct the Board to take those matters into consideration. Finally, Stanford argues that, if it is restricted to the record before the Board, even on that record it is clear that the Board improperly rejected its claims for lack of written description. We consider each issue in turn.

A. Availability of § 146 Proceedings

We held in *Biogen* that the AIA abolished the right of parties to bring civil actions in district court under 35 U.S.C. § 146 for review of Board decisions in interferences declared on or after September 16, 2012. *See Biogen*, 785 F.3d at 654. We concluded that we have exclusive jurisdiction over appeals from decisions of the Board in interferences declared after September 15, 2012, relying on the version of 28 U.S.C. § 1295(a)(4)(A) that existed on September 15, 2012. We subsequently denied rehearing en banc in *Biogen*. After the initial briefing in this case, the Supreme Court also denied certiorari. *Biogen MA v. Japanese Found. for Cancer Research*, 136 S. Ct. 1450 (Mar. 21, 2016).

While Stanford argued in its opening brief that *Biogen* was wrongly decided and that we should rethink our holding there, once the Supreme Court denied certiorari, Stanford did not revisit that argument in its reply brief and did not raise the point at oral argument. To the extent Stanford has not abandoned its objection to *Biogen*, we decline to accept Stanford's invitation to criticize it. *Biogen* is the law in this circuit and we, as a panel, will not revisit it.

B. District Court Discovery

We next turn to the question of whether there is any role the information elicited during discovery in the district court can play in these proceedings. Stanford relies heavily on that information in its appeal from the Board's decisions, contending that it materially alters

what the Board understood in reaching its decisions. CUHK contends that the material is not properly at issue before this court and that the newly elicited facts, in any event, actually support the Board's conclusions and CUHK's arguments.

While the parties spend a great deal of their briefing on the meaning and impact of this discovery, we agree with CUHK's threshold position that we may not consider it and may not remand this matter to direct the Board to do so. Given that the district court did not have subject matter jurisdiction to review the Board's interference decisions, Stanford's attempt to include evidence elicited during proceedings there is inappropriate—the activities in the district court are a nullity when the district court lacks subject matter jurisdiction to consider a matter. *See Ruhrgas AG v. Marathon Oil Co.*, 526 U.S. 574, 577 (1999) ("The requirement that jurisdiction be established as a threshold matter . . . is inflexible and without exception; for jurisdiction is power to declare the law, and without jurisdiction the court cannot proceed at all in any cause." (quoting *Steel Co. v. Citizens for a Better Env't*, 523 U.S. 83, 94–95 (1998)) (brackets, citations, and internal quotations marks omitted)). CUHK cannot waive the district court's lack of jurisdiction through its consent to litigate pre-*Biogen*. *See Ins. Corp. of Ir., Ltd. v. Compagnie des Bauxites de Guinee*, 456 U.S. 694, 702 (1982) ("[N]o action of the parties can confer subject-matter jurisdiction upon a federal court. Thus, the consent of the parties is irrelevant . . . and a party does not waive the requirement by failing to challenge jurisdiction early in the proceedings.") (citations omitted).

Our precedent makes clear that our review of a Board interference decision must be confined to the "four corners" of the record before the Board. *In re Gartside*, 203 F.3d 1305, 1314 (Fed. Cir. 2000); 35 U.S.C. § 144 (2012). CUHK correctly asks that we treat the district court proceedings as if they never occurred. While we ultimate-

ly vacate the Board's decision for other reasons, moreover, we do not do so because new evidence may have been developed in the district court proceedings. It will be up to the Board to decide whether it wishes to reopen the record for that reason, or any other; we express no opinion on whether it should do so.

C. Written Description

We now turn to the heart of Stanford's appeal. We review the Board's legal conclusions *de novo*. *In re Elsner*, 381 F.3d 1125, 1127 (Fed. Cir. 2004). We review factual findings of the Board for substantial evidence. *In re Gartside*, 203 F.3d at 1313–15.

Whether a patent claim satisfies the written description requirement of 35 U.S.C. § 112, paragraph 1, depends on whether the description "clearly allow[s] persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1562–63 (Fed. Cir. 1991) (internal quotation marks omitted) (quoting *In re Gosteli*, 872 F.2d 1008, 1012 (Fed. Cir. 1989)).

> [W]hatever the specific articulation, the test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.

Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc).

Substantial evidence supports a finding that the specification satisfies the written description requirement when "the essence of the original disclosure" conveys the necessary information—"regardless of *how* it" conveys such information, and even when the disclosure's "words

[a]re open to different interpretation[s]." *In re Wright*, 866 F.2d 422, 424–25 (Fed. Cir. 1989) (citations and internal quotation marks omitted, emphasis in original); *see also Falko-Gunter Falkner v. Inglis*, 448 F.3d 1357, 1365–66 (Fed. Cir. 2006) (finding substantial evidence supported written description based on "several passages in the [patentee's] application" and the unrebutted "testimony of [the patentee's] expert," which showed that skilled artisans would understand the invention); *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1346 (Fed. Cir. 2013) (discussing the metaphor from *In re Ruschig*, 379 F.2d 990, 994–95 (CCPA 1967) that a disclosure should "provide sufficient 'blaze marks' to guide a reader through the forest of disclosed possibilities toward the claimed compound").

The parties dispute whether the Board correctly determined that the '018 patent does not disclose the random massively parallel sequencing of nucleic acid sequences claimed in the later-added claims such that a person of skill in the art would have concluded that the Quake inventors were in possession of the method claimed. First, the parties disagree as to whether the reference to Illumina products in the specification, quoted below, adequately discloses *random* massively parallel sequencing as the later-added claims require:

> A methodology useful in the present invention platform is based on massively parallel sequencing of millions of fragments using attachment of randomly fragmented genomic DNA to a planar, optically transparent surface and solid phase amplification to create a high density sequencing flow cell with millions of clusters, each containing ~1,000 copies of template per sq. cm. These templates are sequenced using four-color DNA sequencing-by-synthesis technology. *See, products offered by Illumina, Inc., San Diego Calif.* Also, see US 2003/0022207 to Balasubramanian, et al.,

> published Jan. 30, 2003, entitled "Arrayed polynucleotides and their use in genome analysis."

'018 patent, col. 19, l. 59–col. 20, l. 3 (emphasis added).

On this issue, the Board had to determine what the '018 specification's reference to Illumina products meant *at the time of the invention*, and whether such a reference encompassed random and/or targeted sequencing. "Written description is a question of fact, judged from the perspective of one of ordinary skill in the art as of the relevant filing date." *Falko-Gunter*, 448 F.3d at 1363 (citing *Vas-Cath*, 935 F.2d at 1563–64). The parties do not dispute the February 2007 priority date as it applies to this issue.

The Board concluded that:

> *[G]iven that Dr. Gabriel supports her testimony with published references* and given that the language of the Quake '018 patent at 19:48-20:3 does not preclude targeted massively parallel sequencing, we credit Dr. Gabriel's testimony that those of skill in the art could have considered the references in the '018 patent specification to Illumina products to indicate targeted sequencing.

J.A. 19 (emphasis added). The Board relied on Dr. Gabriel's testimony to conclude that the '018 patent lacked sufficient written support.

We must base our review on the analysis presented by the Board. *SEC v. Chenery Corp.*, 332 U.S. 194, 196 (1947) ("[A] reviewing court, in dealing with a determination or judgment which an administrative agency alone is authorized to make, must judge the propriety of such action solely by the grounds invoked by the agency. If those grounds are inadequate or improper, the court is powerless to affirm the administrative action by substituting what it considers to be a more adequate or proper basis."). The Board stated that it relied on Dr. Gabriel's

testimony, and further noted that Dr. Gabriel relied on documents related to the Roche 454 sequencer and other "published references." We conclude that the Board erred in its reliance on the portions of Dr. Gabriel's testimony that rely on these references.

Both Dr. Gabriel and the Board failed to cite *any* evidence of targeted or random sequencing on the Illumina platform prior to Quake's filing date. Although Dr. Gabriel did point to two post-dated references (Porreca, Nat. Methods 4:931 (2007) and Krishnakumar, Proc. Nat'l Acad. Sci. USA 105:9296 (2008)) that discuss the use of targeted sequencing methods on the Illumina GA and GS-FLX platforms, the Board did not cite to or rely upon these references to support its decision.

Dr. Gabriel also cited to several publications that do not discuss the Illumina platform. These publications describe targeted sequencing methods where a predetermined target sequence can be selected by amplification and then sequenced on an MPS platform. J.A. 4889–90 ¶¶ 19–20. Dr. Gabriel cited to a November 2006 information sheet for the Roche 454 Life Sciences Amplicon Sequencing Template Preparation method, "which describes a targeted sequencing method in which a predetermined target sequence is selected by amplification and then sequenced" on the Roche 454 massively parallel sequencing platform. J.A. 4890 ¶ 20. Dr. Gabriel highlighted Thomas, a 2006 article, as one representative example of a targeted sequencing approach using the Roche 454 platform. J.A. 4890 ¶ 20. And Dr. Gabriel noted two other related articles; one presents further refinement of Thomas's method (Binladen PLoS One 2:e197 (2007)), and the other discusses the use of human target sequences on the Roche 454 platform (Dahl Proc. Nat'l Acad. Sci. USA 104:9387 (2007)). Dr. Gabriel also cited to a chapter in Metzker's 2008 book "Advances in Next-Generation DNA Sequencing Technologies" that discusses a targeted approach for profiling sequence tags

and using the Roche 454 platform to examine microbial microenvironments and ancient DNA. J.A. 4889 ¶ 19.

The Board stated that it relied on Dr. Gabriel's testimony, at least in part, because of the "published references" to which she cited. As discussed above, the Illumina references post-date the 2007 priority date, and the other references discuss a platform not referenced in the '018 patent. All of the published references on which the Board relies focus on the Roche 454 platform, not the Illumina platform actually referenced in the specification. The Board did not cite evidence to connect targeted sequencing on the Roche 454 platform to targeted sequencing on the Illumina system, nor has the Board explained what it found persuasive about the Roche 454 platform references.

Indeed, Stanford offers evidence to show that the Illumina sequencing platform—a second-generation MPS platform first released in 2006—*came after* the Roche 454 platform—a first generation MPS platform first released in 2005. And the systems operate differently: although the Roche 454 system could apply targeting techniques using its low-throughput PCR amplification reactions, the Illumina platform could generate far more data using its high-throughput system but had difficulties applying simple PCR amplification procedures due to its scale. Yet the Board never compared the difficulty of performing targeted or random sequencing on an Illumina platform. We further note that Dr. Gabriel and the Board failed to cite to the Roche 454 references with specificity, leaving us with no reviewable record to conclude that the disclosed methods or platform would have been applicable to Illumina on Quake's priority date.

Dr. Gabriel did testify that those of ordinary skill in the art, both in 2006–07 and today, would consider the Roche 454 platform to be an MPS platform; Stanford does not dispute this point. J.A. 4888 ¶ 17; Appellant Br. 44,

47–52. But both Dr. Gabriel's testimony and the Board's discussion on this issue fail to explain why the Board could properly rely on testimony focused on the Roche 454 platform for any purpose beyond its discussion of MPS platforms in general, when the '018 patent specifically cites to the Illumina platform. Nor has Dr. Gabriel or the Board explained why we should use conclusions about the Roche 454 platform to conclude that Illumina teaches only targeted sequencing.

Second, the Board found that a person of skill in the art "would have understood the discussion of massively parallel sequencing [in the '018 patent] to refer to sequencing targeted, predetermined portions of the DNA in a sample, not sequencing of random DNA." J.A. 20. To support this finding, the Board credits Dr. Gabriel's testimony that a person of skill in the art "could have considered the references in the '018 patent specification to Illumina products to indicate targeted sequencing," in part because "the language of the Quake '018 patent at 19:48-20:3 does not *preclude* targeted massively parallel sequencing." J.A. 19 (emphasis added). The Board's finding that the '018 specification's language does not preclude targeted MPS ignores the fact that the same description might be able to disclose *both* random and targeted sequencing. Put another way, even if the '018 specification *could* indicate targeted sequencing, it could also disclose random sequencing, or it could disclose both random and targeted sequencing. The Board frames its finding in terms of an erroneous premise: the Board's task was to determine whether the '018 patent's written description *discloses random* MPS sequencing, as recited by the later-added claims, not whether the description *does not preclude targeted* MPS sequencing. The Board's error on this issue is compounded by its failure to explain the meaning of key sentences and phrases in the specification's discussion of the sequencing process, and its failure to compare these statements to the claim limita-

tions. For example, the Board failed to explain the meaning of "using attachment of randomly fragmented genomic DNA," "solid phase amplification," or "~1,000 copies of template" in the context of this patent, nor did the Board examine the meaning of "templates" or the specification's statement that "[t]hese templates are sequenced using four-color DNA sequencing-by-synthesis technology." *See* '018 patent, col. 19, l. 48–col. 20, l. 3.

For these reasons, we vacate the interference decisions and remand for the Board to reconsider whether Quake's relevant patents and applications satisfy the written description requirement. *In re Nuvasive, Inc.,* 842 F.3d 1376, 1382 (Fed. Cir. 2016) (finding that the Board must "make the necessary findings and have an adequate 'evidentiary basis for its findings'" (quoting *In re Lee*, 277 F.3d 1338, 1344 (Fed. Cir. 2002)); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015) ("[W]e must not ourselves make factual and discretionary determinations that are for the agency to make.") (citing *In re Lee*, 277 F.3d at 1342, *Interstate Commerce Comm'n v. Bhd. of Locomotive Eng'rs*, 482 U.S. 270, 283 (1987), and *Chenery*, 332 U.S. at 196–97).

On remand, the Board should examine whether a person of ordinary skill in the art would have known, as of the priority date, that the '018 specification's reference to Illumina products meant random MPS sequencing as recited in the claims, by examining the record evidence as to pre-filing date art-related facts on Illumina products. The Board's inquiry may include an analysis of whether the record contains testimony or evidence, relevant to this written description analysis, showing that any post-filing date publications contain art-related facts on random MPS sequencing or Illumina products existing on the filing date. *See, e.g.*, *In re Hogan*, 559 F.2d 595, 605 (CCPA 1977) (in the enablement context, noting that the CCPA permitted the use of "later publications as evidence of the state of the art existing on the filing date of an

application." (citations omitted)); *see also Plant Genetic Sys., N.V. v. DeKalb Genetics Corp.*, 315 F.3d 1335, 1344 (Fed. Cir. 2003) ("[T]he district court looked into post–1987 reports to determine whether monocot cells were readily transformable in 1987 [the priority date] rather than to show that monocot cells could be successfully transformed in 1990. . . . Thus, the district court properly used later reports as evidence of the state of the art existing in 1987."). The Board may not, however, use post-dated references as a source for "later knowledge about later art-related facts . . . which did not exist on the filing date." *Hogan*, 559 F.2d at 605; *see also U.S. Steel Corp. v. Phillips Petroleum Co.*, 865 F.2d 1247, 1251–52 (Fed. Cir. 1989) ("[T]he district court correctly held defendants' evidence immaterial to the section 112, first paragraph inquiry. The central flaw in defendants' evidence, as recognized by the district court, is that it was directed solely to a later state of the art," and therefore, "[d]efendants' misdirected approach here is the same as that improperly relied upon by the PTO in *Hogan*.").

On remand, the Board also should examine whether a person of ordinary skill would have understood that the '018 patent's specification disclosed random MPS sequencing, as opposed to whether the specification did not preclude targeted MPS sequencing.

III. CONCLUSION

For the reasons stated above, we vacate and remand the Board's interference decisions for further proceedings consistent with this opinion.

VACATED AND REMANDED

COSTS

No costs.