NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK,
Appellant

v.

ILLUMINA, INC.,
Appellee

2019-2302, 2019-2303, 2019-2304, 2019-2305, 2019-2452

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Nos. IPR2018-00291, IPR2018-00318, IPR2018-00322, IPR2018-00385, IPR2018-00797.

Decided: February 1, 2021

JOHN D. MURNANE, Venable LLP, New York, NY, argued for appellant. Also represented by ZACHARY L. GARRETT, ROBERT SETH SCHWARTZ; JUSTIN J. OLIVER, Washington, DC; JOHN P. WHITE, Cooper & Dunham, LLP, New York, NY.

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Redwood Shores, CA, argued for appellee. Also represented by DEREK C. WALTER; BRIAN GEORGE LIEGEL, Miami, FL.

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

LOURIE, *Circuit Judge*.

The Trustees of Columbia University in the City of New York ("Columbia") appeal from two final written decisions of the U.S. Patent and Trademark Office Patent Trial and Appeal Board ("the Board") holding claim 1 of U.S patent 9,718,852 ("the '852 patent"), claim 1 of U.S. Patent 9,719,139 ("the '139 patent"), claim 1 of U.S. Patent 9,708,358 ("the '358 patent"), claim 1 of U.S. Patent 9,725,480 ("the '480 patent"), and claims 1–2 of U.S. Patent 9,868,985 ("the '985 patent") unpatentable as obvious. *See Illumina, Inc. v. Trustees of Columbia Univ. in the City of New York*, Nos. IPR2018-00291, IPR2018-00318, IPR2018-00322, IPR2018-00385, 2018 WL 8619911 (P.T.A.B. June 21, 2019) ("*Decision I*"), J.A. 1–81; *Illumina, Inc. v. Trustees of Columbia Univ. in the City of New York*, No. IPR2018-00797 (P.T.A.B. Sept. 9, 2019), J.A. 82–162 ("*Decision II*"). For the reasons detailed below, we *affirm*.

BACKGROUND

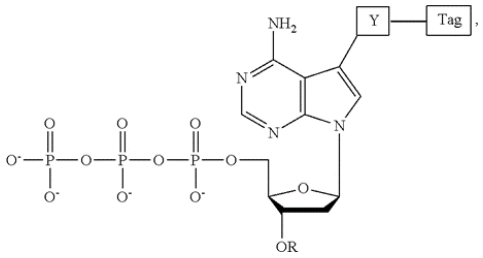
The '852, '139, '358, '480, and '985 patents (collectively, "the patents") are directed to nucleotide analogs and a method of using nucleotide analogs to sequence DNA. Appellant Br. at 2. The method is called sequencing-by-synthesis ("SBS"). *Id.* SBS works by "detecting the identity of a nucleotide analogue after the nucleotide analogue is incorporated into a growing strand of DNA." '852 patent col. 4 ll. 46–48.

The patents explain that SBS generally includes the following steps: First SBS requires "mak[ing] nucleotide analogues" by (a) "linking a unique label such as a

fluorescent dye or a mass tag through a cleavable linker to the nucleotide base or an analogue of the nucleotide base" and (b) "us[ing] a small cleavable chemical moiety to cap the 3′-OH group of the deoxyribose to make it nonreactive."[1] '852 patent col. 3 ll. 4–11. The "nucleotide analogue[]" is incorporated "into the growing DNA strand as [a] terminator[]." *Id.* col. 3 ll. 11–13. Second, "[d]etection of the unique label will yield the sequence identity of the nucleotide," i.e., adenine, thymine, guanine, or cytosine. *Id.* col. 3 ll. 13–14. Third "[u]pon removing the label and the 3′-OH capping group, the polymerase reaction will proceed to incorporate the next nucleotide analogue and detect the next base." *Id.* col. 3 ll. 14–17. "These steps (incorporation of the modified nucleotide, identification of the label, cleavage of the capping group and the label) result in one nucleotide being sequenced and are known as a 'cycle' of SBS." Appellant Br. at 10.

Claim 1 of the '852 patent reads as follows:

1. An adenine deoxyribonucleotide analogue having the structure:



wherein R *(a) represents a small, chemically cleavable, chemical group capping the oxygen at the 3' position of the deoxyribose of the deoxyribonucleotide analogue*, (b) does not interfere with

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[1] Because the patents share a substantially similar specification, all citations are to the '852 patent unless otherwise noted. *Decision*, 2018 WL 8619911, at *2.

recognition of the analogue as a substrate by a DNA polymerase, (c) is stable during a DNA polymerase reaction, and *(d) does not contain a ketone group;*

wherein OR is not a methoxy group or an ester group;

wherein the covalent bond between the 3′-oxygen and R is stable during a DNA polymerase reaction;

wherein tag represents a detectable fluorescent moiety;

wherein Y represents a chemically cleavable, chemical linker which (a) does not interfere with recognition of the analogue as a substrate by a DNA polymerase and (b) is stable during a DNA polymerase reaction; and

wherein the adenine deoxyribonucleotide analogue:

i) is recognized as a substrate by a DNA polymerase,

ii) is incorporated at the end of a growing strand of DNA during a DNA polymerase reaction,

iii) produces a 3′-OH group on the deoxyribose upon cleavage of R,

iv) no longer includes a tag on the base upon cleavage of Y, and

v) is capable of forming hydrogen bonds with thymine or a thymine nucleotide analogue.

’852 patent col. 34 l. 2–col. 35 l. 4 (emphases added).

The '139, '358, and '480 patents recite substantially the same claim as claim 1 of the '852 patent but with a different base: '139 (thymine), '358 (cytosine), and '480 (guanine). *See* '139 patent col. 34 l. 2–col. 35 l. 6; '358 patent col 34 l. 2–col. 35 l. 4; '480 patent col. 34 l. 2–col. 35 l. 4; Appellant Br. at 24. Lastly, the '985 patent includes method claims for sequencing DNA using the nucleotide analogs claimed in the other four patents. Independent claim 1 of the '985 patent recites, in relevant part, "[a] method for sequencing a nucleic acid which comprises detecting the identity of a nucleotide analogue incorporated into the end of a growing strand of DNA in a polymerase reaction . . . ." '985 patent col. 34 l. 2–col. 36. l. 28.

This appeal primarily centers on one aspect of the claims: the use of a capping group that is "small," and not a "ketone group," "a methoxy group, or an ester group." '852 patent col. 34 ll. 18–26; '139 patent col. 34 ll. 18–26; '358 patent col 34 ll. 17–24; '480 patent col. 34 ll. 19–25; '985 patent col. 35 l. 27–col. 36 l. 1; *see also* Appellant Br. at 21–22. According to Columbia, the inventors discovered that a capping group should have these characteristics in order to "work for SBS." Appellant Br. at 22. Relevant to this appeal an "allyl capping group" is small, and is not ketone, methoxy, or ester. *See Decision I*, 2018 WL 8619911, at *7, *28.

Illumina, Inc. ("Illumina") filed petitions for *inter partes* review of the '852, '139, '358, '480, and '985 patents. In the petitions, it asserted that certain combinations of prior art references would have rendered obvious the use of a labeled nucleotide analog with an allyl capping group. The prior art references include (1) Tsien et al., WO 91/06678 (May 16, 1991) ("Tsien"), (2) James M. Prober et al., *A System for Rapid DNA Sequencing with Fluorescent Chain-Terminating Dideoxynucleotides*, 238 SCIENCE 336–41 (Oct. 16, 1987) ("Prober"), (3) Michael L. Metzker et al., *Termination of DNA synthesis by novel 3′- modified-deoxyribonucleoside 5'-triphosphates*, 22 NUCLEIC ACIDS

RESEARCH 4259–67 (1994) ("Metzker"), and (4) Dower et al., U.S. Patent 5,547,839, Aug. 20, 1996 ("Dower").

Like the patents, Tsien discloses that DNA can be sequenced using the SBS method. *See* J.A. 3412–13; *Decision I*, 2018 WL 8619911, at *9; Appellant Br. at 27. Tsien specifically teaches that allyl capping groups can be used for SBS. *See* J.A. 3430; *see also Decision I*, 2018 WL 8619911, at *16.

Dower similarly teaches that DNA can be sequenced with the SBS method. *See* J.A. 3491; *Decision I*, 2018 WL 8619911, at *8. Dower discloses that "small" capping groups can be used for SBS. J.A. 3497.

Metzker discloses a method of sequencing DNA "equivalent to SBS." *Decision I*, 2018 WL 8619911, at *10; J.A. 3500. Metzker describes an experiment in which "eight 3′-modified dNTPs" with different capping groups were "examined for their ability to terminate DNA synthesis." J.A. 3500. The presumption in Metzker is that capping groups that terminated DNA synthesis would potentially be good candidates for use with DNA sequencing. In Metzker's experiment, 3′-O-allyl nucleotides (nucleotides with allyl capping groups) showed "Termination*." *Id.* at 3504. Metzker explains that the asterisk after termination means that "activity was *incomplete* at a final concentration of 250 μM." *Id.* (emphasis added). In contrast to the 3′-O-allyl nucleotides, Metzker's experiment shows that nucleotides with other capping groups demonstrated "Termination" (without an asterisk). *Id.* Metzker reports that those other capping groups were "interesting" and "were further evaluated." J.A. 3504, 3506. Prober discloses limitations not at issue in this appeal. *See* Appellant Br. at 26 n.6.

The Board issued two final written decisions, one regarding the patents with nucleotide analog claims and one regarding the patent with method claims. The Board first concluded that claim 1 of the '852 patent would have been obvious over the combination of (1) Tsien and Prober, or (2)

Prober, Dower, and Metzker. *See Decision I*, 2018 WL 8619911, at *21, *23. The Board further concluded that the claims of the other four patents are unpatentable as obvious, based on similar reasoning. *See id.* at *24; *Decision II*, slip op. at 77–78.

In concluding that the claims would have been obvious, the Board first found that Tsien discloses the use of allyl capping groups. *See Decision I*, 2018 WL 8619911, at *16; *Decision II*, slip op. at 41. The Board rejected Columbia's argument that Metzker's experiment, which demonstrated that 3′-O-allyl nucleotides showed only "incomplete" termination, would have negated Tsien's teaching. *See Decision I*, 2018 WL 8619911, at *18–19; *Decision II*, slip op. at 45. The Board also determined that a person of ordinary skill would have understood that Metzker's experiment could be further improved by "increasing [nucleotide] concentration or reaction time." *Id.* Administrative Patent Judge Worth dissented in both decisions, believing that "Metzker's experiment would have discouraged a person of ordinary skill from pursuing an allyl nucleotide." *Decision I*, 2018 WL 8619911, at *33; J.A. 160–161. Columbia appealed to this court. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

We review the Board's legal determinations de novo, *In re Elsner*, 381 F.3d 1125, 1127 (Fed. Cir. 2004), and the Board's factual findings underlying those determinations for substantial evidence, *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000). A finding is supported by substantial evidence if a reasonable mind might accept the evidence to support the finding. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938).

Obviousness is a question of law based on underlying facts, including the scope and content of the prior art, differences between the prior art and the claims at issue, the level of ordinary skill, and relevant evidence of secondary

considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). "What the prior art teaches, whether a person of ordinary skill in the art would have been motivated to combine references, and whether a reference teaches away from the claimed invention are questions of fact." *Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) (citing *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1047–48 (Fed. Cir. 2016) (en banc)). "The presence or absence of a reasonable expectation of success is also a question of fact." *PAR Pharm., Inc. v. TWi Pharms., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014).

Columbia challenges the Board's determination regarding the obviousness of the claims in three respects. First, Columbia asserts that the Board erred in determining that a person of ordinary skill would have been motivated to pursue an allyl capping group for use with SBS. Second, Columbia argues that the Board erred in determining that a person of ordinary skill would have had a reasonable expectation of success in using an allyl capping group for SBS. Third, Columbia argues that the Board erred in determining that person of ordinary skill would have had a reasonable expectation of success in specifically incorporating 3′-O-allyl thymine, cytosine, or guanine nucleotides into a DNA strand during SBS. We address each argument in turn.

I

Columbia first argues that the Board erred in determining that a person of ordinary skill "would have been motivated to pursue the allyl capping group for [use with] SBS." Appellant Br. at 31. Columbia contends that the Board's error stemmed from its "misapprehension" of Metzker's experiment. *Id.* at 34–35. According to Columbia, the asterisk after "Termination*" in Metzker's experiment indicated that 3′-O-allyl nucleotides were inefficiently incorporated into the DNA strand and resulted in poor termination. *See id.* at 16–17. Columbia asserts that such

a result would have discouraged a person of ordinary skill from using an allyl capping group because SBS requires efficient incorporation of nucleotides. As support for its argument, Columbia points to Metzker's disclosure that only nucleotides with capping groups that showed "Termination" (without an asterisk) were advanced for further testing. Columbia further points out that other scientists allegedly ceased experimenting with allyl capping groups after Metzker was published, instead choosing to pursue "non-allyl capping groups, such as 2-nitrobenzyl." *Id.* at 40. Columbia thus argues that Metzker's experiment pointed away from Tsien's[2] disclosure that allyl capping groups can be used for SBS. *Id.* at 35.

Illumina responds that the Board's determination was supported by substantial evidence. It contends that Metzker's experiment would not have discouraged a person of ordinary skill from pursuing an allyl capping group. According to Illumina, Metzker's experiment expressly showed that 3′-O-allyl nucleotides achieved some measure of termination. Illumina asserts that the asterisk, which signifies that termination was not complete, does not nullify Metzker's essential teaching.

We agree with Illumina that the Board's conclusion was supported by substantial evidence. Teaching away requires "'clear discouragement' from implementing a technical feature." *Univ. of Md. Biotechnology Inst. v. Presens Precision Sensing GmbH*, 711 F. App'x. 1007, 1011 (Fed. Cir. 2017) (quoting *In re Ethicon, Inc.*, 844 F.3d 1344, 1351 (Fed. Cir. 2017)). Columbia has not demonstrated that

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[2] Columbia asserts that "[t]he Board's obviousness framework was the same for Illumina's [g]rounds focusing on Tsien and those focusing on Dower. As such, [Columbia's] arguments herein apply to all [g]rounds." Appellant Br. at 27 n.8; *see also* Appellant Reply Br. at 13 n.6. Accordingly, our analysis here also applies to both grounds.

there was any such clear discouragement. First, as an initial matter, the Board determined that Tsien discloses allyl capping groups for use with DNA sequencing, which Columbia does not substantively dispute. *See Decision I*, 2018 WL 8619911, at *16; *Decision II*, slip op. at 41. Second, the Board carefully evaluated Metzker and found that it confirms rather than negates Tsien's teachings. *Decision I*, 2018 WL 8619911, at *18; *Decision II*, slip op. at 45. The Board's determination was supported by ample evidence. Metzker's experiment reports that 3′-O-allyl nucleotides showed "Termination*," indicating that they *terminated* DNA synthesis. J.A. 3504. Columbia places much weight on the asterisk after "Termination*." However, the asterisk merely indicates that although termination was achieved, it was not complete in the conditions used for the particular experiment. *Id.* Metzker never describes the experiment with allyl capping groups as a failure. On the contrary, when describing the results of the experiment, Metzker expressly states that 3′-O-allyl nucleotides were "incorporated" by polymerase. *Id.* at 3506.

Lastly, while it may be true that Metzker and other scientists ultimately chose to research alternative capping groups, "just because better alternatives exist in the prior art" does not mean that an inferior alternative "is inapt for obviousness purposes." *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012) (citing *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)). Accordingly, the Board's determination was supported by substantial evidence.

II

We turn next to Columbia's second argument. Columbia argues that the Board erred in determining that a person of ordinary skill would have had a reasonable expectation of success in using labeled 3′-O-allyl nucleotides for SBS. Appellant Br. at 46. Specifically, Columbia asserts that "Tsien's prophetic disclosures from 1991 would [not] have provided" an expectation that labeled 3′-O-allyl

nucleotides would work successfully for SBS, "i.e., would be capable of at least twenty cycles of sequencing." *Id.* at 46–47. As support for its argument, Columbia asserts that in a prior reexamination, Solexa (which was acquired by Illumina) asserted that Tsien provided no expectation that allyl capping groups could work successfully for SBS. Columbia also again asserts here that Metzker negates Tsien's teaching.

We disagree with Columbia. First it should be said that a reasonable expectation of success does not mean achieving the best of all possible results. Success may not have only one definition. And the Board's determination regarding reasonable expectation of success was supported by substantial evidence. Overall, Columbia's arguments here are largely duplicative of its motivation arguments. As discussed above, Columbia does not dispute that Tsien discloses allyl capping groups for use with SBS. Moreover, we are unpersuaded by Columbia's argument that Illumina's statements in the separate reexamination are evidence that Tsien would not have provided a person of ordinary skill with a reasonable expectation of success. The Board evaluated Columbia's argument but found it unconvincing because the previous reexamination concerned an earlier priority date than Columbia's patents had. The Board thus determined that arguments made in the reexamination "would not necessarily be relevant to the level of skill in the art and the reasonable expectation of success . . . [at] the time of filing of the '852 patent." *Decision I*, 2018 WL 8619911, at *31; *see also Decision II*, slip op. at 75. We agree.[3] And we further reject Columbia's argument that

[3] Columbia additionally contends that in another separate proceeding, Illumina made statements that allegedly "undercut" its arguments in this proceeding. Columbia Motion at 1, ECF No. 51. Columbia has in fact made a motion asking us to take judicial notice of those

the differences in the priority dates are "inconsequential" because the priority date considered in the separate *ex parte* reexamination was September 2000, only a month apart from the October 2000 priority date of Columbia's patents. Appellant Br. at 57. Columbia ignores that the Board examined the record and determined that "there is no evidence that the Examiner adopted a finding based on the level of skill in September 2000." *Decision I*, 2018 WL 8619911, at *31 n.44. Rather, the Board found that "the examiner's findings" in the reexamination "considered the level of skill in the art (and reasonable expectations based thereon) as of September 2, 1994." *Decision I*, 2018 WL 8619911, at *31; *see also Decision II*, slip op. at 75 n.43.

Second, the Board found that although Metzker's experiment demonstrated that 3′-O-allyl nucleotides showed only "Termination*," a person of ordinary skill would have understood how to improve incorporation efficiency. Specifically, the Board found that a person of ordinary skill would have known that "increasing concentration [of nucleotides] or reaction time could help incorporation efficiency." *Decision I*, 2018 WL 8619911, at *19; *Decision II*, slip op. 45. The Board's determination was adequately supported by the testimony of Dr. Romesberg, whom the Board found credible. *Id.* Columbia makes an array of arguments as to why the Board erred in relying on Dr. Romesberg's testimony, all unconvincing. For example, Columbia asserts that Dr. Romesberg's testimony regarding increasing nucleotide concentration is irrelevant because, inter alia (1) "Dr. Romesberg relied on experiments done with a methoxy nucleotide (3′-O-methyl) rather than a 3′-O-allyl nucleotide" and (2) it is known that increasing nucleotide concentration can "increase[] mutation rate." Appellant Br. at 50–52. However, the Board considered these

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proceedings. *Id.* We decline to do so. We limit ourselves to the present record.

arguments. It reasonably found that "[a]lthough some evidence indicates that use of high concentration can cause problems, the weight of the evidence does not support a finding that these problems would have discouraged the skilled artisan . . . ." *Decision I*, 2018 WL 8619911, at *19 (internal citation omitted); *Decision II*, slip op. at 46. Columbia effectively urges us to reweigh the evidence presented to the Board and reach a different conclusion. But "[t]his court does not reweigh evidence on appeal." *Celgene Corp. v. Peter*, 931 F.3d 1342, 1352 (Fed. Cir. 2019) (quoting *In re NTP, Inc.*, 654 F.3d 1279, 1292 (Fed. Cir. 2011)).

Third, the specifications of Columbia's patents provide further evidence that a person of ordinary skill would have had a reasonable expectation of success in using allyl capping groups for SBS. Although Columbia now argues that Metzker was discouraging, its patents' disclosures contradict Columbia's assertion. Specifically, the patents cite Metzker (the same prior art reference at issue here) as evidence that allyl groups can be "used to cap the 3′-OH group using *well-established* synthetic procedures." '852 patent col. 26 ll. 22–25 (emphasis added). The patents additionally state that Metzker showed incorporation of 3′-O-allyl nucleotides "in the growing strand of DNA." *See, e.g.*, '852 patent col. 3 ll. 28–30 ("3′-O-allyl-dATP was also shown to be incorporated by Ventr(exo−) DNA polymerase in the growing strand of DNA (Metzke[r] et al. 1994)."). We are unpersuaded by Columbia's argument that the patents' citation of Metzker is immaterial because "whether a [person of ordinary skill] would have known the synthetic chemistry to make the claimed nucleotides is irrelevant . . . to whether a [person of ordinary skill] would reasonably expect such nucleotides to work for SBS." Appellant Br. at 60. Here, the patents cite Metzker without mentioning concerns regarding the use of allyl capping groups. *See PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1362 (Fed. Cir. 2007) ("Admissions in the specification regarding the prior art are binding on the patentee for

purposes of a later inquiry into obviousness." (citing *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1570 (Fed. Cir. 1988)). Indeed, as the Board pointed out, although the patents cite Metzker, they do not otherwise "provide data establishing good incorporation or efficiency of an allyl group." *Decision I*, 2018 WL 8619911, at *3; *see also id.* at *19 (quoting *Trustees of Columbia Univ. in the City of New York v. Illumina, Inc.*, 620 F. App'x. 916, 933 (Fed. Cir. 2015) ("[I]f novel and nonobvious chemistry was needed to practice the claimed inventions [the patentee] would have been obligated to disclose this chemistry in the patent.")); *Decision II*, slip op. at 6, 46.

Columbia additionally asserts that the Board erred in "fail[ing] to properly consider" that Metzker only discloses a "3′-O-allyl nucleotide [that is] *unlabeled* (which cannot be used for SBS), whereas the relevant claimed embodiment in the Columbia patents is a *labeled* 3′-O-allyl nucleotide." Appellant Br. at 54 (emphases in original) (internal citations omitted). However, we have held "on multiple occasions that failure to explicitly discuss every issue or every piece of evidence does not alone establish that the tribunal did not consider it." *Novartis AG v. Torrent Pharms. Ltd.*, 853 F.3d 1316, 1328 (Fed. Cir. 2017). Although the Board did not expressly reference Columbia's label argument, it was not obliged to discuss every argument that Columbia raised. And regardless, Tsien discloses labeled nucleotides. J.A. 3419.

In sum, although Columbia faults the Board for both "misapprehending" Metzker and for erroneously relying on expert testimony, Columbia has not pointed to any flaw in the Board's analysis. The Board was presented with two alternative theories as to whether a person of ordinary skill would have had a reasonable expectation of success in using an allyl capping group for SBS. "Our task is not to determine which theory we find more compelling." *See Shoes by Firebug LLC v. Stride Rite Children's Grp., LLC*, 962 F.3d 1362, 1371 (Fed. Cir. 2020). Rather, the only question

before us is whether the Board's conclusion was supported by substantial evidence. Here, we conclude that it was.

III

Finally, we turn to Columbia's argument that the Board erred in holding that a person of ordinary skill would have expected to succeed in incorporating "labeled 3′-O-allyl thymine, cytosine, and guanine nucleotides" into a DNA strand, as required by the '139, '358, and '480 patent claims, respectively. Appellant Br. at 62. Columbia contends that Metzker only discloses the inefficient incorporation of 3′-O-allyl *adenine* nucleotides. According to Columbia, Metzker provided no evidence that a "labeled 3′-O-allyl thymine, cytosine, or guanine nucleotide would have any polymerase activity at all." *Id.* at 63.

We disagree. The Board carefully weighed the evidence and found that the references "collectively suggest that the analogues discussed therein are capable of being incorporated at the end of a growing strand of DNA." *Decision I*, 2018 WL 8619911, at *24; *Decision II*, slip op. at 52. Indeed, Tsien discloses that allyl capping groups can be used for all base types without distinction. *See, e.g.*, J.A. 3412–13, 3430; *see also Decision I*, 2018 WL 8619911, at *24. Similarly, Dower teaches SBS without indicating that different base types can raise unique issues. *See, e.g.*, J.A. 3481; *see also Decision I*, 2018 WL 8619911, at *24. Accordingly, the Board's determination was supported by substantial evidence.

CONCLUSION

We have considered Columbia's remaining arguments and find them unpersuasive. The Board's decisions were supported by substantial evidence and were not erroneous as a matter of law. For the foregoing reasons, the decisions of the Board are *affirmed*.

AFFIRMED