NOTE: This disposition is nonprecedential.

United States Court of Appeals for the Federal Circuit

IN RE: MOHAMMAD A. MAZED,
Appellant

2024-1756

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. 16/602,403.

Decided: January 10, 2025

MOHAMMAD A. MAZED, Yorba Linda, CA, pro se.

SHEHLA WYNNE, Office of the Solicitor, United States Patent and Trademark Office, Alexandria, VA, for appellee Derrick Brent. Also represented by AMY J. NELSON, MAUREEN DONOVAN QUELER, FARHEENA YASMEEN RASHEED.

Before LOURIE, REYNA, and CHEN, *Circuit Judges*.

LOURIE, *Circuit Judge*.

Mohammad A. Mazed appeals from the decision of the U.S. Patent and Trademark Office Patent Trial and Appeal Board ("the Board") affirming the Examiner's rejections of claims 85 and 87 of U.S. Patent Application 16/602,403

("the '403 application")[1] for obviousness under 35 U.S.C. § 103. *In re Mazed*, No. 2024-000723, 2024 WL 3200453 (P.T.A.B. Apr. 2, 2024) ("*Decision*"). For the following reasons, we *affirm*.

BACKGROUND

I

On September 28, 2019, Mazed filed a patent application entitled "Molecular System for Cancer Biology" directed to engineered dendritic cells for use in cancer immunotherapy. J.A. 29, 85. The '403 application explains that the claimed invention can be used "for enhanced interaction with a T-cell and/or a natural killer cell against a particular type of cancer cells." *See* '403 application at Abstract, J.A. 85. For example, in one embodiment, the '403 application describes that the engineered dendritic cells "can train other types of immune cells (especially the T-cells and/or natural killer cells) to recognize and destroy existing cancer cells in the human body." *Id.* at ¶ 224, J.A. 69. The engineered dendritic cells can include DNA, RNA, and XNA origami nanostructures to enhance cell-cell interactions. *Id.* at ¶ 225, J.A. 69–70.

Independent claim 85 of the '403 application recites:

> 85. An engineered dendritic cell comprising:
>
> (a) a first bioactive molecule;
>
> wherein the first bioactive molecule is selected from a group consisting of a co-stimulating molecule, a mobility enhancing molecule, and a programming molecule,

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[1] The '403 application was published on April 23, 2020, as U.S. Patent Application Publication 2020/0123575.

> (b) a second bioactive molecule to activate (i) a T-cell, and/or (ii) a natural killer cell;
>
> (c) an identifying protein on a cancer cell; and
>
> (d) a first scaffold of a biocompatible polymer for interaction with the T-cell, and/or the natural killer cell against the cancer cell,
>
> wherein the first scaffold comprises
>
> a deoxyribonucleic acid (DNA) based origami,
>
> or
>
> a ribonucleic acid (RNA) based origami,
>
> or
>
> a XNA based origami
>
> wherein XNA comprises genetic bases of adenine (A), thymine (T), guanine (G), cytosine (C), and uracil (U), wherein XNA further comprises one or more synthetic or artificial genetic bases,
>
> wherein the first bioactive molecule, the second bioactive molecule, the identifying protein, and the first scaffold are coupled.

Decision at *1; *see also* J.A. 360–61. Claim 87 depends from claim 85 and recites that the engineered dendritic cell

"further compris[es] a protein to detect a molecular event within the cancer cell." *Decision* at *1; *see also* J.A. 361.[2]

II

The Examiner rejected claims 85 and 87 as obvious over the combination of Chang 2011,[3] Chang 2020,[4] and Ma.[5] *Decision* at *1.

Chang 2011 discloses an antigen presenting cell ("APC") comprising nucleic acid nanostructures that promote cell-cell interactions, which can be used to treat mammalian tumors. *See* J.A. 521, Abstract. Specifically, it discloses "compositions comprising a first ligand that is capable of binding to a receptor of a first cell type, a second ligand that is capable of binding to a receptor of a second cell type, wherein the first ligand and the second ligand are bound to a nucleic acid nanostructure." J.A. 539, ¶ 8. As Chang 2011 describes, a nucleic acid nanostructure "refers to a nucleic acid structure that includes at least one nanoscale dimension, wherein the nucleic acid structure comprises one or more single stranded nucleic acids, which hybridize to form at least a partially double-stranded structure with defined features and geometry." J.A. 544, ¶ 65. The nucleic acid nanostructure can include a DNA origami, and the term "nucleic acid" includes DNA, RNA,

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[2] On appeal, Mazed does not independently challenge the Board's decision with respect to claim 87. *See* Mazed Br. 43. We therefore do not separately address this claim.

[3] U.S. Patent Application Publication 2011/0275702, J.A. 521–62.

[4] U.S. Patent Application Publication 2020/0385734, J.A. 563–663.

[5] Daphne Y. Ma & Edward A. Clark, *The role of CD40 and CD154/CD40L in dendritic cells*, 21 SEMINARS IN IMMUNOLOGY 265 (2009), J.A. 664–73.

and "analogues thereof." *Id.* ¶¶ 66–67. Chang 2011 further explains that T-cells and natural killer cells are "major players in tumor immunity," J.A. 539, ¶ 6, and that its invention aims to "augment[] tumor immunity by promoting cell-cell interaction," *id.* ¶ 7.

Chang 2020 discloses RNA nanostructures for use in treating patients with cancer. J.A. 589, ¶ 3. Its nanostructures have the sequence: $(R_3)_n$-NR_1-L-NR_2-$(R_4)_m$ where NR_1 and NR_2 can represent RNA nanostructures, R_3 and R_4 can represent RNA targeting strands which can be operably linked to a targeting moiety (*e.g.*, a protein or peptide) that binds to a target, and L represents a linker. J.A. 589, ¶¶ 10–14; J.A. 591, ¶ 31. In some embodiments, one or more of R_3 and R_4 is a protein, such as a "tumor targeting peptide (TTP), a human cancer peptide, or calreticulin protein." J.A. 592, ¶ 41.

Ma describes the role of CD40–CD154 in dendritic cells. As Ma explains, CD40 is a "transmembrane glycoprotein surface receptor that is a member of the tumor necrosis factor receptor superfamily," and CD154 is its ligand. J.A. 664.

III

On appeal from the Examiner's rejection of claims 85 and 87 over those references, the Board affirmed. In doing so, the Board accepted the Examiner's interpretation of various claim terms, including "engineered," "coupled," and "biocompatible polymer." *Decision* at *2–3. Agreeing with the Examiner, the Board determined that, in the absence of a definition within the specification, the term "engineered" encompasses cells that have been modified in a lab for a certain task, such that an "engineered dendritic cell" means a "cell that has been man made in order to induce an interaction with another cell." *See id.* at *2 (cleaned up). The Board further agreed with the Examiner that the term "coupled" does not require any of the claimed components (*i.e.*, the first bioactive molecule, the second

bioactive molecule, the identifying protein, and the first scaffold) to be arranged in any specific arrangement or to have a "direct protein-protein interaction." *See id.* at *3. Therefore, the Board accepted the Examiner's interpretation that the claim term "mean[s] that the dendritic cell itself is the structure that couples" those components. *Id.* (cleaned up). Finally, the Board agreed with the Examiner that, in the absence of a definition in the specification for "biocompatible polymer," that term encompasses strands of XNA. *Id.*

Based on those interpretations, the Board affirmed the rejection of claim 85, finding no error in the Examiner's conclusion that:

> the combination of Chang 2011, Chang 2020, and Ma makes obvious an engineered [dendritic cell] that expresses a first bioactive molecule, CD40/CD40L, that is a programming molecule, a second bioactive molecule, MHC [*i.e.*, major histocompatibility complex, a bioactive molecule], that activates a T cell, and further comprises an XNA origami biocompatible polymer scaffold that comprises an identifying protein on a cancer cell, e.g., NY-ESO-1, wherein the first bioactive molecule, the second bioactive molecule, XNA origami, and identifying protein are all coupled via the engineered [dendritic cell].

Id. at *7. The Board did not find persuasive Mazed's arguments that CD40 is not a "programming molecule," as recited in the claim, concluding that that argument did not address the teachings of Ma. *Id.*

Mazed timely appealed. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

On appeal, Mazed raises two primary challenges to the Board's decision. First, he argues that the Board's

interpretation of the claim terms "engineered dendritic cell," "coupled," and "biocompatible polymer" were erroneous. Second, he argues that the Board's factual findings underlying its obviousness analysis were not supported by substantial evidence. We address each argument in turn.

I

"Claims in pending applications receive their broadest reasonable interpretation during examination." *In re Fought*, 941 F.3d 1175, 1177 (Fed. Cir. 2019). Under that standard, claim terms are given their plain and ordinary meaning as understood by a person of ordinary skill in the art, unless that meaning is inconsistent with the specification. *See In re Bass*, 314 F.3d 575, 577 (Fed. Cir. 2002). We review the Board's claim construction *de novo* and its underlying factual findings involving extrinsic evidence for substantial evidence. *In re Man Mach. Interface Techs. LLC*, 822 F.3d 1282, 1285 (Fed. Cir. 2016).

Beginning with "engineered dendritic cell," Mazed argues that that term is limited to a "lab-made dendritic cell with all added synthetic biocomponents." Mazed Br. 13; *id.* at 16 ("Engineered dendritic cell requires consistent addition of synthetic molecules, but cannot rely on occasionally naturally expressed biomolecules[.]"). That is, Mazed argues that the claimed invention does not include engineered dendritic cells that incorporate naturally-occurring bioactive molecules. We disagree. As the Board observed, the '403 application does not define the term "engineered," and nothing in the specification or claim language supports interpreting that language to including only synthetic biocomponents. *Decision* at *3. For example, the claims merely require the first bioactive molecule to be selected from a "co-stimulating molecule, a mobility enhancing molecule, and a programming molecule," and the second bioactive molecule to be able to activate a T-cell or natural killer cell. Neither of those

requirements limits the bioactive molecules to synthetic biocomponents. Moreover, Mazed does not point to any disclosure in the specification or claim language that supports his view. *See* Mazed Br. 13. The Board therefore did not err in interpreting "engineered dendritic cell" to mean a "cell has been man made in order to induce an interaction with another cell." *Decision* at *2.

As for the term "coupled," Mazed does not appear to directly dispute the Board's interpretation of that term as not requiring any of the claimed components to be arranged in any specific arrangement. However, he does attempt to distinguish Chang 2020 by arguing that the reference "clear[ly] discourage[s]" binding an identifying protein "directly onto an engineered dendritic cell," as he purports is claimed. Mazed Br. 19. However, as the Board correctly found, nothing in the claim language or specification requires the identifying protein to be bound directly to the dendritic cell. And Mazed again fails to point to any disclosure to show otherwise. *See id.*

Finally, with respect to the claimed "biocompatible polymer," Mazed argues that a person of ordinary skill in the art would have understood that term to mean "(i) a polylactic-co-glycolic acid or (ii) polyLactic Acid." Mazed Br. 21. That is, Mazed argues that the Board's interpretation that the claimed "biocompatible polymer" can include polymers of nucleic acids, such as DNA, RNA, or XNA, was error. In his view, under the Board's interpretation, the claimed biocompatible polymer is a "missing element" from the prior art because the "scaffold made of a biocompatible polymer is distinct from a DNA scaffold." *Id.* at 23–24. Again, we disagree. The claim recites "a first scaffold of a biocompatible polymer . . . wherein the first scaffold comprises a [DNA] based origami, or a [RNA] based origami, or a XNA based origami." J.A. 361. Contrary to Mazed's argument, the plain language of the claim does not require the "first

scaffold of a biocompatible polymer" to be distinct from the claimed DNA, RNA, or XNA origami. *See Decision* at *10.

For those reasons, we see no error in the Board's interpretation of the claim terms.

II

Mazed's remaining arguments purport to challenge the sufficiency of the Board's obviousness analysis. We review the Board's obviousness analysis *de novo* and its underlying findings of fact for substantial evidence. *In re Couvaras*, 70 F.4th 1374, 1378 (Fed. Cir. 2023).

On appeal, Mazed argues that the Board "never explained" why the claimed engineered dendritic cell "would have been an obvious choice." Mazed Br. 33. In Mazed's view, there was an insufficient motivation to combine the prior art to arrive at the claimed invention with a reasonable expectation of success. *Id.* at 34–37. We disagree and find that substantial evidence supports the Board's conclusion that a person of ordinary skill in the art would have been motivated to combine the prior art to arrive at the claimed invention with a reasonable expectation of success.

As the Board explained, a person of ordinary skill in the art would have been motivated "to prepare the engineered APC comprising the origami nanostructure for interacting with a T cell as taught by Chang (2011), and choose a dendritic cell as the APC comprising an origami nanostructure for binding a synthetic peptide tumor antigen as taught by Chang (2020) with a reasonable expectation of success." *Decision* at *6. That is because both references—having the same author—are directed to use of engineered nanostructures in cancer immunotherapy, and the dendritic cells of Chang 2020 are a subtype of the APCs taught by Chang 2011. *Id.* at *6–7. The Board further explained that a person of ordinary skill in the art would have looked to Ma as teaching that the

first bioactive molecule, CD40/CD40L, is a programming molecule, as required by the claim. *See id.* at *7–8. The Board further detailed how those references, in combination, would have rendered obvious each and every limitation of the claimed invention. *See generally id.* at *6–13. Substantial evidence therefore supports the Board's obviousness analysis.

CONCLUSION

We have considered Mazed's remaining arguments and find them unpersuasive. For the reasons provided, we *affirm*.

AFFIRMED

No costs.