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UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

**CERTAIN MICROFLUIDIC SYSTEMS
AND COMPONENTS THEREOF AND
PRODUCTS CONTAINING SAME**

Inv. No. 337-TA-1100

INITIAL DETERMINATION ON VIOLATION OF SECTION 337

Administrative Law Judge Dee Lord

(July 12, 2019)

Appearances:

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For the Commission Investigative Staff:

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Pursuant to the Notice of Investigation (Dec. 13, 2017) and Commission Rule 210.42, this is the administrative law judge's final initial determination in the matter of *Certain Microfluidic Systems and Components Thereof and Products Containing Same*, Commission Investigation No. 337-TA-1100. 19 C.F.R. § 210.42(a)(1)(i).¹

For the reasons discussed herein, it is my final initial determination that there is a violation of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and/or the sale within the United States after importation of certain microfluidic systems and components thereof and products containing same by reason of infringement of certain claims of U.S. Patent No. 9,689,024 ("the '024 Patent"), U.S. Patent No. 9,695,468 ("the '468 Patent"), and U.S. Patent No. 9,856,530 ("the '530 Patent"). There is no violation with respect to U.S. Patent No. 9,644,204 ("the '204 Patent").

¹ Pursuant to Commission Rule 210.42(a)(1)(ii), a recommended determination on remedy and bonding shall issue within 14 days of this initial determination. 19 C.F.R. § 210.42(a)(1)(ii).

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The following abbreviations may be used in this Initial Determination:

Tr.	Transcript
WS	Witness Statement
DWS	Direct Witness Statement
RWS	Rebuttal Witness Statement
JX	Joint Exhibit
CX	Complainant's exhibit
CPX	Complainant's physical exhibit
CDX	Complainant's demonstrative exhibit
RX	Respondent's exhibit
RPX	Respondent's physical exhibit
RDX	Respondent's demonstrative exhibit
CPHB	Complainant's pre-hearing brief
CIB	Complainant's initial post-hearing brief
CRB	Complainant's reply post-hearing brief
RPHB	Respondent's pre-hearing brief
RIB	Respondent's initial post-hearing brief
RRB	Respondent's reply post-hearing brief
SPHB	Staff's pre-hearing brief
SIB	Staff's initial post-hearing brief
SRB	Staff's reply post-hearing brief

I. BACKGROUND

A. Procedural History

The Commission instituted this investigation in response to a complaint filed by 10X Genomics, Inc. (“10X”) alleging violations of section 337 of the Tariff Act of 1930, as amended, by reason of infringement of certain claims of U.S. Patent No. 9,644,204 (“the ’204 Patent”), U.S. Patent No. 9,689,024 (“the ’024 Patent”), U.S. Patent No. 9,695,468 (“the ’468 Patent”), and U.S. Patent No. 9,856,530 (“the ’530 Patent”) by Respondent Bio-Rad Laboratories, Inc. (“Bio-Rad”). The Commission ordered that an investigation be instituted to determine:

whether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain microfluidic systems and components thereof and products containing same by reason of infringement of one or more of claims 1-4, 6-9, 17, 20, 21, 23, 25, 27, 29, 31, and 33 of the ’204 Patent; claims 1, 2, 5, 8, 10, 11, 13, 15-17, 19, 21, and 22 of the ’024 Patent; claims 1-4, 6-9, 11, 12, 21, and 22 of the ’468 Patent; and claims 1-6, 8-11, 14-20, and 24-30 of the ’530 Patent; and whether an industry in the United States exists as required by subsection (a)(2) of section 337;

Notice of Investigation at 2. The investigation was instituted upon publication of the notice of investigation in the *Federal Register* on Wednesday, February 21, 2018. 83 Fed. Reg. 7491-92 (2018); *see* 19 C.F.R. § 210.10(b). Bio-Rad filed a response to the complaint and notice of investigation on March 6, 2018.

A *Markman* hearing was held in this investigation on July 25, 2018, and a *Markman* order, issued on October 31, 2018. Order No. 22.

On October 5, 2018, 10X’s motion for summary determination was granted pursuant to a stipulation between 10X and Bio-Rad that 10X has satisfied the economic prong of the domestic industry requirement. Order No. 19 (Oct. 5, 2018), *not reviewed by* Comm’n Notice (Nov. 6, 2018).

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10X withdrew its allegations of infringement with respect to claims 2, 8, 10, 11, 13, 15, 16, and 21 of the '024 patent, claims 1, 2, 3, 4, 6, 7, 8, 9, 17, 20, 21, 23, and 25 of the '204 patent, claims 2, 3, 4, 8, 11, 12, and 22 of the '468 patent, and claims 2, 3, 5, 6, 8, 9, 10, 15, 16, 17, 18, 20, 24, 25, 27, 29, and 30 of the '530 patent. Order No. 26 (Nov. 30, 2018); Order No. 27 (Dec. 10, 2018); Comm'n Notice (Dec. 21, 2018). Part of Bio-Rad's inventorship defense was terminated pursuant to Order No. 34 (Feb. 21, 2019), *not reviewed by* Comm'n Notice (Mar. 13, 2019). The evidentiary hearing proceeded on March 25-29, 2019, and the target date was extended to November 12, 2019, pursuant to Order No. 45 (May 29, 2019), *not reviewed by* Comm'n Notice (Jun. 13, 2019).

B. The Private Parties

1. Complainant

The complainant is 10X Genomics, Inc. ("10X"). Notice of Investigation at 2. 10X was founded in 2012 in Pleasanton, California, where it maintains its headquarters and a manufacturing facility. Complaint ¶ 6 (Jan. 9, 2018); Order No. 19 at 3-4 (Oct. 5, 2018).

2. Respondents

The respondent is Bio-Rad Laboratories, Inc. ("Bio-Rad"). Notice of Investigation at 2. Bio-Rad is a Delaware corporation with its principal place of business in Hercules, California. Response to Complaint ¶ 22 (Mar. 6, 2018).

C. Products at Issue

The products at issue are microfluidic cartridges, droplet generation instruments, and assays used in single-cell sequencing.

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1. Domestic Industry

The domestic industry products (“DI products”) are 10X’s GemCode™ and Chromium™ product lines. Order No. 19 at 3. These products were developed by 10X based on its GEM (“Gel bead in Emulsion”) architecture, and the first GemCode™ product was sold in 2015. CX-0003C (Schnall-Levin DWS) at Q/A 47-52. The DI products include both single-cell and linked-read applications, including the Chromium™ Single Cell 3’ Solution, Chromium™ Single Cell V(D)J Solution, and GemCode™ Single Cell platform (collectively, “10X’s single-cell applications”), and the Chromium™ Genome Solution, Chromium™ Exome Solution, Chromium™ *de novo* Assembly Solution, and GemCode™ Long Read platform (collectively, “10X’s linked-read applications”). Order No. 19 at 3. Pursuant to Order No. 19, 10X has satisfied the economic prong of the domestic industry requirement with respect to these products. *See* Comm’n Notice (Nov. 6, 2018).

2. Accused Products

The accused products are components and assays of Bio-Rad’s ddSEQ system, which includes ddSEQ [REDACTED]. CIB at 4-5; RIB at 11-12. The ddSEQ v1 products include Bio-Rad’s ddSEQ v1 Cartridge, ddSEQ v1 Single-Cell Isolator, ddSEQ Cartridge Holder, and consumables and assays used with and/or as part of Bio-Rad’s ddSEQ v1 system including the SureCell WTA 3’ v1 assay. *Id.*; CX-0004C (Butte DWS) at Q/A 54; RX-0665C (Metzger RWS) at Q/A 29. The ddSEQ [REDACTED]
[REDACTED]
[REDACTED]. *Id.* Bio-Rad has admitted that each of the ddSEQ v1 instruments and the v1 [REDACTED]
[REDACTED]. CX-0041C at Interrogatory Nos. 4 and 5; *see* RPHB at 53.

D. Background of Asserted Patents

1. The '024 and '468 Patents

Through application 13/966,150 (“the ’150 application”), which was filed on August 13, 2013, the ’468 and ’024 patents claim priority to six provisional applications filed between August 14, 2012 and July 10, 2013. ’024 patent (JX-0003), cover; ’468 patent (JX-0005), cover. The ’024 patent was filed as a divisional of the ’150 application and the ’468 patent was filed as a continuation of the ’150 application. ’024 patent, cover; ’468 patent, cover. Because of their ancestry, the ’024 and ’468 patents share a common specification. The patents identify Benjamin Hindson, Serge Saxonov, and Michael Schnall-Levin as inventors. ’024 patent, cover; ’468 patent, cover.

Analysis of biological materials, such as sequencing nucleic acids, requires proper sample preparation. ’024 patent, col. 1:28-30. “Sample preparation may . . . involve fragmenting molecules, isolating molecules, and/or attaching unique identifiers to particular fragments of molecules” *Id.* at col. 1:34-37. A microwell partition capsule array can be used in sample preparation operations. *Id.*, col. 4:28-29. Such a device consists of “an assembly of partitions (*e.g.*, microwells, droplets) that are loaded with microcapsules.” *Id.*, col. 4:24-27. The array divides the sample “such that a portion of the sample is present in each partition.” *Id.*, col. 4:29-32. Each partition “may include one or more capsules that contain one or more reagents (*e.g.*, enzymes, unique identifiers (*e.g.*, bar codes), antibodies, *etc.*).” *Id.*, col. 4:41-44. A “trigger” can be used to cause the microcapsules to release the reagents into the partitions, so that the reagents come into contact with the subdivided sample. *Id.*, col. 4:44-48.

Microcapsules are used (1) to “provide for the controlled and/or timed release of reagents for sample preparation of an analyte,” (2) to control the release and transport of reagents, (3) to

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deliver reagents in discrete and definable amounts, (4) to “prevent premature mixing of reagents with the sample,” and (5) to ease handling of and limit contact with reagents. *Id.*, col. 6:62-col. 7:13. Microcapsules can be formed using gel beads. *Id.*, col. 9:28-35. Analytes and/or reagents can “be coupled/ immobilized to the interior surface of a gel bead (*e.g.*, the interior accessible via diffusion of an oligonucleotide barcode and/or materials used to generate an oligonucleotide barcode) and/or the outer surface of a gel bead.” *Id.*, col. 9:36-42. Release of the analytes or reagents from the microcapsule may be the result of applying a trigger. *Id.*, col. 22:4-6. Various types of stimuli can be used as a trigger, including chemical stimuli, enzymes, light, heat, and magnetic fields. *Id.*, col. 19:43-48, col. 22:4-21.

One sample preparation reagent that can be delivered by a microcapsule is a “molecular barcode.” *Id.*, col. 12:9-14. For most applications, such as in the case of the nucleic acid sequencing, analyzing multiple samples simultaneously “substantially decreases the cost of analysis as well as increases through-put of the process.” *Id.*, col. 12:33-36. To analyze multiple samples, different samples are pooled together. *Id.*, col. 12:36-39. Before the samples are pooled together, the analytes from each sample are tagged with a unique identifier, known in the art as a “molecular barcode,” so that analytes from different samples can be identified and tracked in the pooled sample. *Id.*, col. 12:11-13, col. 12:36-39. Molecular barcodes “may comprise a variety of different forms such as oligonucleotide bar codes, antibodies or antibody fragments, fluorophores, nanoparticles, and other elements or combinations thereof.” *Id.*, col. 12:14-17. In nucleic acid sequencing, oligonucleotide barcodes are particularly useful. *Id.*, col. 12:43-44.

2. The '204 Patent

The '204 patent issued on May 9, 2017 from an application filed on February 7, 2014. '204 patent (JX-0001), cover. The '204 patent claims priority to four provisional applications filed between February 8, 2013 and July 10, 2013. The provisional applications to which the '204 patent claims priority are also relied on for priority by the '024 and '468 patents. The patent names Benjamin Hindson, Serge Saxonov, Kevin Ness, Paul Hardenbol, Christopher Hindson, Donald Masquelier, Mirna Jarosz, and Michael Schnall-Levin as inventors. Three of the named inventors—Dr. Hindson, Dr. Saxonov, and Dr. Schnall-Levin—are also the named inventors of the '024 and '468 patents.

The disclosed subject matter of the '204 patent is similar to that of the '024 and '468 patents. As with those patents, the '204 patent is directed to sample preparation methods and discloses “compositions comprising a plurality of capsules, the capsules situated within droplets in an emulsion, wherein the capsules are configured to release their contents into the droplets upon the application of a stimulus.” *Id.*, col. 1:42-46. The capsules may contain reagents and/or analytes. *Id.*, col. 1:47-48.

3. The '530 Patent

The '530 patent issued on January 2, 2018 from an application filed on May 5, 2017. '530 patent (JX-0007), cover. Through intervening applications, the '530 patent is a continuation in part of an application filed on February 7, 2014. *Id.* The '530 patent also claims priority to five provisional applications filed between December 14, 2012 and July 10, 2013. *Id.* Four of the provisional applications to which the '204 patent claims priority are also relied on for priority by the '024, '468, and '204 patents. The patent names Benjamin Hindson, Serge Saxonov, Kevin Ness, Paul Hardenbol, Mirna Jarosz, and Michael Schnall-Levin as inventors.

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These same individuals are named inventors of the '204 patent and three of them—Dr. Hindson, Dr. Saxonov, and Dr. Schnall-Levin—are also named inventors of the '024 and '468 patents.

The claimed subject matter of the '530 patent is similar to the subject matter disclosed in the '024, '468, and '204 patents. As with those patents, the '530 patent discloses sample preparation methods that use microcapsules and beads to provide reagents and analytes in response to stimuli. '530 patent, col. 23:60-col. 24:13.

E. Level of Ordinary Skill in the Art

In the *Markman* order, I adopted Bio-Rad's proposed definition for the level of ordinary skill in the art: either a Ph.D. in molecular biology, molecular genetics, chemistry, engineering, or equivalent disciplines with two years of experience or [B.S.] in such fields with five years of experience, with such experience including library preparation methods, microfluidic technology, and/or bead attachment chemistries. Order No. 22 at 2-3.

F. Witness Testimony

I received testimonial evidence in this investigation in the form of witness statements, live testimony, and deposition designations.

1. Fact Witnesses

10X began the hearing with the testimony of Benjamin Hindson, co-founder of 10X and co-inventor of the asserted patents. CX-0001C; CX-1828C; Tr. 132-187. The next witness was Michael Schnall-Levin, a vice president at 10X and another co-inventor of the asserted patents. CX-0003C; CX-1830C; Tr. 189-231. 10X also called Serge Saxonov, its CEO and also a co-founder of 10X and co-inventor of the asserted patents. CX-1829C; Tr. 768-820.

Bio-Rad presented the testimony of Annette Tumolo, the president of its Life Sciences Group. RX-0502C; Tr. 509-511. Bio-Rad also presented the testimony of Douglas Greiner, a

senior manager in its product development group. RX-0507C; RX-0727C; Tr. 511-565. Bio-Rad also called another of its employees, Nicholas Heredia, who is an alleged co-inventor of the asserted patents. RX-0504C; Tr. 565-604. In addition, Bio-Rad presented the testimony of one of its former employees, Kelly Kaihara (RX-0506C), and she was examined as an adverse witness by 10X. Tr. 234-282. Bio-Rad also presented the testimony of its employee Jeremy Agresti (RX-0503C), who was further examined as an adverse witness by 10X. Tr. 283-348.

2. Expert Witnesses

10X's expert on infringement is Atul Butte, whose testimony was qualified as that of an expert in the field of genomic sequencing solutions. CX-0004C; Tr. 351-474 (expert qualification at 364:9-17). 10X's expert on invalidity is Paul Dear, whose testimony was qualified as that of an expert in the field of genomic sequencing solutions. CX-1827C; Tr. 822-934 (expert qualification at 828:20-829:1).

Bio-Rad's technical expert is Michael Metzker, whose testimony was qualified as that of an expert in next generation sequencing, including sample preparation technologies, microfluidics, enzyme chemistry, high throughput assays, bead properties and attachment chemistries. RX-0664C; RX-0665C; Tr. 608-767 (expert qualification at 613:22-614:14), 935-961.

The parties also stipulated to the admission of witness statements from Thomas Vander Veen (CX-0005C) and Ryan Herrington (RX-0666C), and their designated deposition transcripts (JX-0162C and JX-0170C), discussing the issues of remedy and bond. Tr. 24-25.

3. Deposition Designations

10X submitted designated deposition transcripts for several witnesses: Jeremy Agresti (CX-0009C), Mark DiPanfilo (CX-0010C), Lucas Frenz (CX-0011C), Jodi Goodrich (CX-

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0012C), Nicholas Heredia (CX-0014C and CX-0015C), Kelly Kaihara (CX-0016C), Ronald Lebofsky (CX-0018C), Dan Norton (CX-0019C), Carolyn Reifsnyder (CX-0020C), Annette Tumolo (CX-0022C), and Svilen Tzonev (CX-0023C). Tr. 23.

Bio-Rad also submitted designated deposition transcripts for several witnesses: Paul Hardenbol (RX-0396C), Benjamin Hindson (RX-0399C), Christopher Hindson (RX-0400C), Mirna Jarosz (RX-0401C), Donald Masquelier (RX-0405C), Kevin Ness (RX-0408C), Serge Saxonov (RX-0412C), and Michael Schnall-Levin (RX-0413C). Tr. 23-24.

II. JURISDICTION

In order to have the power to decide a case, a court or agency must have both subject matter jurisdiction and jurisdiction over either the parties or the property involved. 19 U.S.C. § 1337; *Certain Steel Rod Treating Apparatus and Components Thereof*, Inv. No. 337-TA-97, Commission Memorandum Opinion, 215 U.S.P.Q. 229, 231 (1981).

A. Subject Matter Jurisdiction

Section 337 confers subject matter jurisdiction on the Commission to investigate, and if appropriate, to provide a remedy for, unfair acts and unfair methods of competition in the importation, the sale for importation, or the sale after importation of articles into the United States. *See* 19 U.S.C. §§ 1337(a)(1)(B) and (a)(2). The Commission has subject matter jurisdiction over this investigation based on 10X's allegation that Bio-Rad has imported the accused products. *Amgen Inc. v. Int'l Trade Comm'n*, 902 F.2d 1532, 1536 (Fed. Cir. 1990). Bio-Rad does not contest the Commission's subject matter jurisdiction in this investigation. RPHB at 53.

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B. Personal Jurisdiction

Bio-Rad does not contest the Commission's *in personam* jurisdiction in this investigation. RPHB at 49. Bio-Rad has submitted to the personal jurisdiction of the Commission by answering the Complaint and Notice of Investigation, participating in discovery, appearing at hearings, and filing motions and briefs. *See Certain Miniature Hacksaws*, Inv. No. 337-TA-237, USITC Pub. No. 1948, Initial Determination at 4, 1986 WL 379287, *1 (Oct. 15, 1986), *not reviewed in relevant part by Comm'n Action and Order*, 1987 WL 450871 (Jan. 15, 1987).

C. In Rem Jurisdiction

The Commission has *in rem* jurisdiction over the accused products by virtue of their importation into the United States. *See Sealed Air Corp. v. U.S. Int'l Trade Comm'n*, 645 F.2d 976, 985-86 (C.C.P.A. 1981) (holding that the ITC's jurisdiction over imported articles is sufficient to exclude such articles). Bio-Rad does not contest that it has imported, sold for importation, and/or sold after importation certain ddSEQ products. RPHB at 53.

III. LEGAL STANDARDS

A. Infringement

Section 337(a)(1)(B)(i) prohibits "the importation into the United States, the sale for importation, or the sale within the United States after importation by the owner, importer, or consignee, of articles that – (i) infringe a valid and enforceable United States patent or a valid and enforceable United States copyright registered under title 17." 19 U.S.C. §1337(a)(1)(B)(i). The Commission has held that the word "infringe" in Section 337(a)(1)(B)(i) "derives its legal meaning from 35 U.S.C. § 271, the section of the Patent Act that defines patent infringement." *Certain Electronic Devices with Image Processing Systems, Components Thereof, and Associated Software*, Inv. No. 337-TA-724, Comm'n Op. at 13-14 (December 21, 2011). Under 35 U.S.C. § 271(a), direct infringement of a patent consists of making, using, offering to sell, or

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selling the patented invention without consent of the patent owner.

In addition to direct infringement, a respondent may be liable for indirect infringement, including induced infringement, which is defined in section 271(b) of the Patent Act: “Whoever actively induces infringement of a patent shall be liable as an infringer.” 35 U.S.C. § 271(b). *See DSU Med. Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1305 (Fed. Cir. 2006) (*en banc*) (“To establish liability under section 271(b), a patent holder must prove that once the defendants knew of the patent, they actively and knowingly aided and abetted another’s direct infringement.”) (citations omitted). “The mere knowledge of possible infringement by others does not amount to inducement; specific intent and action to induce infringement must be proven.” *Id.* (citations omitted). The Federal Circuit has held that induced infringement “requires knowledge that the induced acts constitute . . . infringement.” *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 766 (2011). In *Suprema, Inc. v. Int’l Trade Comm’n*, the Federal Circuit upheld the Commission’s interpretation of the section 337 language “articles that infringe” in the context of induced infringement, holding that the statute “covers goods that were used by an importer to directly infringe post-importation as a result of the seller’s inducement.” 796 F.3d 1338, 1352-53 (Fed. Cir. 2015).

Another form of indirect infringement is contributory infringement, defined in section 271(c) of the Patent Act: “Whoever offers to sell . . . or imports into the United States a component of a patented machine, . . . or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer.” 35 U.S.C. § 271(c). The intent requirement for contributory

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infringement requires that respondent knows “that the combination for which [the] component was especially designed was both patented and infringing.” *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. at 763. A violation of section 337 based on contributory infringement requires that “the accused infringer imported, sold for importation, or sold after importation within the United States, the accused components that contributed to another’s direct infringement.” *Spansion, Inc. v. Int’l Trade Comm’n*, 629 F.3d 1331, 1353 (Fed. Cir. 2010).

“An infringement analysis entails two steps. The first step is determining the meaning and scope of the patent claims asserted to be infringed. The second step is comparing the properly construed claims to the device accused of infringing.” *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (*en banc*), *aff’d*, 517 U.S. 370 (1996) (citation omitted). Infringement must be proven by a preponderance of the evidence. *SmithKline Diagnostics, Inc. v. Helena Labs. Corp.*, 859 F.2d 878, 889 (Fed. Cir. 1988). A preponderance of the evidence standard “requires proving that infringement was more likely than not to have occurred.” *Warner-Lambert Co. v. Teva Pharm. USA, Inc.*, 418 F.3d 1326, 1341 n.15 (Fed. Cir. 2005).

A complainant must prove either literal infringement or infringement under the doctrine of equivalents. Literal infringement requires the patentee to prove that the accused device contains each and every limitation of the asserted claim(s). *Frank’s Casing Crew & Rental Tools, Inc. v. Weatherford Int’l, Inc.*, 389 F.3d 1370, 1378 (Fed. Cir. 2004). “If even one limitation is missing or not met as claimed, there is no literal infringement.” *Elkay Mfg. Co. v. EBCO Mfg. Co.*, 192 F.3d 973, 980 (Fed. Cir. 1999). Literal infringement is a question of fact. *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d 1323, 1332 (Fed. Cir. 2008).

B. Invalidity

It is the respondents' burden to prove invalidity, and the burden of proof never shifts to the patentee to prove validity. *Scanner Techs. Corp. v. ICOS Vision Sys. Corp. N.V.*, 528 F.3d 1365, 1380 (Fed. Cir. 2008). "Under the patent statutes, a patent enjoys a presumption of validity, *see* 35 U.S.C. § 282, which can be overcome only through facts supported by clear and convincing evidence" *SRAM Corp. v. AD-II Eng'g, Inc.*, 465 F.3d 1351, 1357 (Fed. Cir. 2006); *see also Microsoft Corp. v. i4i Ltd. P'ship*, 564 U.S. 91, 100-114 (2011) (upholding the "clear and convincing" standard for invalidity).

The clear and convincing evidence standard placed on the party asserting an invalidity defense requires a level of proof beyond the preponderance of the evidence. Although not susceptible to precise definition, "clear and convincing" evidence has been described as evidence that produces in the mind of the trier of fact "an abiding conviction that the truth of a factual contention is 'highly probable.'" *Price v. Symsek*, 988 F.2d 1187, 1191 (Fed. Cir. 1993) (quoting *Buildex, Inc. v. Kason Indus., Inc.*, 849 F.2d 1461, 1463 (Fed. Cir. 1988)).

1. Anticipation

Pursuant to 35 U.S.C. § 102, a patent claim is invalid as anticipated if:

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant;
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States;
- (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent;
- (g)(2) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it.

35 U.S.C. § 102 (2000).² “A patent is invalid for anticipation if a single prior art reference discloses each and every limitation of the claimed invention. Moreover, a prior art reference may anticipate without disclosing a feature of the claimed invention if that missing characteristic is necessarily present, or inherent, in the single anticipating reference.” *Schering Corp. v. Geneva Pharm., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003) (citations omitted).

2. Obviousness

Section 103 of the Patent Act states:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

35 U.S.C. § 103(a) (2000).³

“Obviousness is a question of law based on underlying questions of fact.” *Scanner Techs.*, 528 F.3d at 1379. The underlying factual determinations include: “(1) the scope and content of the prior art, (2) the level of ordinary skill in the art, (3) the differences between the claimed invention and the prior art, and (4) objective indicia of non-obviousness.” *Id.* (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)). These factual determinations are often referred to as the “*Graham* factors.”

The critical inquiry in determining the differences between the claimed invention and the prior art is whether there is a reason to combine the prior art references. *KSR Int’l Co. v. Teleflex*

² As explained in the revision notes and legislative reports in 35 U.S.C.A. § 100 (May 13, 2015), the language of 35 U.S.C. § 102 that was effective prior to the America Invents Act controls in this investigation.

³ See *supra*, n.2.

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Inc., 550 U.S. 398, 418-21 (2007). In *KSR*, the Supreme Court rejected the Federal Circuit's rigid application of the teaching-suggestion-motivation test. While the Court stated that "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does," it described a more flexible analysis:

Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

Id. at 418. Applying *KSR*, the Federal Circuit has held that, where a patent challenger contends that a patent is invalid for obviousness based on a combination of prior art references, "the burden falls on the patent challenger to show by clear and convincing evidence that a person of ordinary skill in the art would have had reason to attempt to make the composition or device . . . and would have had a reasonable expectation of success in doing so." *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1360 (Fed. Cir. 2007).

In addition to demonstrating that a reason exists to combine prior art references, the challenger must demonstrate that the combination of prior art references discloses all of the limitations of the claims. *Hearing Components, Inc. v. Shure Inc.*, 600 F.3d 1357, 1373-1374 (Fed. Cir. 2010), *abrogated on other grounds by Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898 (2014) (upholding finding of non-obviousness based on substantial evidence that the asserted combination of references failed to disclose a claim limitation); *Velandier v. Garner*, 348

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F.3d 1359, 1363 (Fed. Cir. 2003) (explaining that a requirement for a finding of obviousness is that “all the elements of an invention are found in a combination of prior art references”).

C. Domestic Industry

In patent-based proceedings under section 337, a complainant must establish that an industry “relating to the articles protected by the patent . . . exists or is in the process of being established” in the United States. 19 U.S.C. § 1337(a)(2). Under Commission precedent, the domestic industry requirement of section 337 consists of an “economic prong” and a “technical prong.” See, e.g., *Alloc, Inc. v. Intl Trade Comm’n*, 342 F.3d 1361, 1375 (Fed. Cir. 2003). To meet the technical prong, the complainant must establish that it practices at least one claim of the asserted patent. *Certain Point of Sale Terminals and Components Thereof*, Inv. No. 337-TA-524, Order No. 40 at 17-18 (Apr. 11, 2005). “The test for satisfying the ‘technical prong’ of the industry requirement is essentially [the] same as that for infringement, *i.e.*, a comparison of domestic products to the asserted claims.” *Alloc*, 342 F.3d at 1375.

With respect to the “economic prong,” subsection (3) of Section 337(a) provides:

For purposes of paragraph (2), an industry in the United States shall be considered to exist if there is in the United States, with respect to the articles protected by the patent, copyright, trademark, mask work, or design concerned –

- (A) significant investment in plant and equipment;
- (B) significant employment of labor or capital; or
- (C) substantial investment in its exploitation, including engineering, research and development, or licensing.

19 U.S.C. § 1337(a)(3).

IV. THE '024 PATENT

A. Asserted Claims

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10X is asserting claims 1, 5, 17, 19, and 22 of the '024 patent. Claim 1 is independent and the remaining claims depend directly or indirectly from claim 1. Claim 1 recites:

A method for sample preparation, comprising:

- a) providing a droplet comprising a porous gel bead and a target nucleic acid analyte, wherein said porous gel bead comprises at least 1,000,000 oligonucleotide molecules comprising barcode sequences, wherein said oligonucleotide molecules are releasably attached to said porous gel bead, wherein said barcode sequences are the same sequence for said oligonucleotide molecules;
- b) applying a stimulus to said porous gel bead to release said oligonucleotide molecules from said porous gel bead into said droplet, wherein upon release from said porous gel bead, a given oligonucleotide molecule from said oligonucleotide molecules attaches to said target nucleic acid analyte; and
- c) subjecting said given oligonucleotide molecule attached to said target nucleic acid analyte to nucleic acid amplification to yield a barcoded target nucleic acid analyte.

'024 patent (JX-0003), col. 33:56-col. 34:7.

Claims 5 and 19 depend directly from claim 1. Claim 5 requires that the stimulus applied to the gel bead be “selected from the group consisting of a biological stimulus, a chemical stimulus, a thermal stimulus, an electrical stimulus, a magnetic stimulus, and a photo stimulus.”

Id., col. 34:15-19. Claim 19 requires that the oligonucleotide molecules attach to the target nucleic acid analytes by hybridization. *Id.*, col. 34:65-67. Claim 17 depends on claim 16, which requires that the droplet “comprise[] a plurality of target nucleic acid analytes, which plurality of target nucleic acid analytes comprises said target nucleic acid analyte.” *Id.*, col. 34:54-56.

Claim 17 requires that each of the plurality of target nucleic acid analytes attach to one of the oligonucleotide molecules. *Id.*, col. 34:58-61. Claim 22 depends on claim 21, which requires that the gel bead be formed from polymer gel. *Id.*, col. 35:4-5. Claim 22 requires that the polymer gel be a polyacrylamide. *Id.*, col. 35:6-7.

B. Claim Construction

The parties agreed to construe “barcode” to mean a “label that may be attached to an analyte to convey identifying information about the analyte.” Order No. 22 at 2. They agreed to construe “applying a stimulus to said porous gel bead to release said oligonucleotide molecules from said porous gel bead into said droplet” to have its plain and ordinary meaning. *Id.* In the *Markman* order, “1,000,000 oligonucleotides comprising barcode sequences” was construed to mean “1,000,000 oligonucleotide molecules that include, but are not necessarily limited to, barcode sequences.” *Id.* at 17-22. The term “releasably attached” was construed to mean “attached in a manner that allows the attached object to be released.” *Id.* at 22-30. The terms “amplify” and “amplification” were construed to mean “increasing the number of copies of the target sequence to be detected,” including by reverse transcription and without requiring amplification to be performed in a droplet. *Id.* at 31-45.

C. Infringement

10X accuses Bio-Rad’s ddSEQ system (v1 [REDACTED]) of infringing claims 1, 5, 17, 19, and 22 of the ’024 patent.

1. Claim 1

There is no dispute that the ddSEQ system includes a method of sample preparation, as recited in the preamble of claim 1, and 10X relies on Dr. Butte’s testimony to identify steps corresponding to each limitation. CX-0004C at Q/A 109-226.

a. “providing a droplet . . .”

There is no dispute with respect to a majority of the elements in the first limitation of claim 1, which requires “providing a droplet comprising a porous gel bead and a target nucleic acid analyte,” wherein the porous gel bead has certain characteristics. CIB at 8-19; SIB 24-29.

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Dr. Butte identifies [REDACTED] gel beads used by the ddSEQ system, which are “porous because each bead has a three-dimensional network of pores [REDACTED] [REDACTED] CX-0004C at Q/A 116. He identifies the steps of making droplets in the ddSEQ v1 workflow, *Id.* at Q/A 61-66, and the [REDACTED]. *Id.* at Q/A 73-80. He further identifies a targeted nucleic acid analyte: mRNA from a cell or a genomic DNA fragment. *Id.* at Q/A 116-17, 120-23. Bio-Rad does not dispute 10X’s allegations with respect to the “porous gel bead” or “nucleic acid analyte.”

The claim limitation further requires that the porous gel bed “comprises at least 1,000,000 oligonucleotide molecules comprising barcode sequences,” and Dr. Butte cites Bio-Rad documents for the ddSEQ v1 process describing a concentration of oligonucleotides in a droplet with a volume consistent with [REDACTED]. CX-0004C at Q/A 128 (citing JX-0050C). This is consistent with Dr. Agresti’s deposition testimony, where he was asked, “How many oligo molecules are attached to each gel bead in ddSEQ?” CX-0009C at 434. He answered: [REDACTED] *Id.*

[REDACTED] CX-0004C at Q/A 133 (citing JX-0090C; CX-1529C). Dr. Agresti confirmed that the number of oligonucleotides in the scATAC-seq is [REDACTED] CX-0009C at 436-37. Bio-Rad disputed this limitation in its pre-hearing brief, RPHB at 57, but does not raise this argument in its post-hearing briefs. *See* RIB at 50-68; RRB at 5-14.

The next element of this limitation requires that “said oligonucleotide molecules are releasably attached to said porous gel bed.” As discussed above, “releasably attached” was construed to mean “attached in a manner that allows the attached object to be released.” *Id.* at

22-30. There is no dispute that the oligonucleotide molecules in Bio-Rad's ddSEQ system are attached to the gel bead. See RRB at 5-6. 10X relies on Dr. Butte's opinion that the oligonucleotide molecules are "releasably attached" to the gel bead through a "linker" that is [REDACTED] CX-0004C at Q/A 143-45 (citing JX-0050C.00026). Bio-Rad's expert, Dr. Metzker, explains that the [REDACTED] in the oligonucleotides of the accused products, [REDACTED]:

[REDACTED]

RX-0665C at Q/A 78-79 (citing JX-0087.00005).

10X contends that [REDACTED] in the accused ddSEQ system shows that the oligonucleotide molecules are "releasably attached." CIB at 12-15. There is no dispute that an oligonucleotide molecule containing barcode sequences is released after [REDACTED] [REDACTED] Staff agrees that this process shows that the accused products meet the "releasably attached" limitation. SIB at 26-29.

Bio-Rad argues that its products do not meet the "releasably attached" limitation because [REDACTED] are part of a long oligonucleotide molecule that contains the barcode sequences and is attached to the gel bead. RIB at 54-59. When [REDACTED] are removed by [REDACTED] [REDACTED] part of the long oligonucleotide molecule is thus destroyed, and Bio-Rad argues that destroying part of an oligonucleotide molecule is inconsistent with the claim language requiring

that the “oligonucleotide molecules are releasably attached.” RIB at 54-59.

In reply, 10X explains that the accused “oligonucleotide molecule” is the molecule that is released [REDACTED], and no portion of this molecule is destroyed when it is released. CRB at 2. Relying on the opinions of Dr. Butte, 10X divides the Bio-Rad’s long oligonucleotide into an accused “oligonucleotide molecule” and a separate “linker.”

[REDACTED]

CRB at 2; CX-0004C (Butte DWS) at Q/A 143-45. Bio-Rad argues that there is no basis for dividing the oligonucleotide in this way, RRB at 5-8, but there are examples of linkers described in the specification. ’024 patent, col. 9:57-58 (identifying “chemical linkers”); *see* SIB at 28. Moreover, there is nothing that precludes the claimed “oligonucleotide molecule” from being part of a larger oligonucleotide molecule—as recognized in the *Markman* order, the claim’s “recital of ‘oligonucleotide molecules’ without a qualifier encompasses both larger and smaller oligonucleotide molecules.” Order No. 22 at 19. Bio-Rad fails to identify any intrinsic or extrinsic evidence that precludes 10X from identifying the accused portion of Bio-Rad’s oligonucleotide as the claimed “oligonucleotide molecule.” The claim only requires that the accused “oligonucleotide molecule” include the claimed barcode sequences and that it be released—the molecule identified by 10X meets these limitations.

Bio-Rad further argues that the construction of “releasably attached” requires a reversible process, citing a discussion of the prosecution history in the *Markman* order. RIB at 54-57; RRB at 8. The portion of the *Markman* order cited by Bio-Rad does not support the

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imposing a “reversible” limitation on the claims, however. At the *Markman* hearing, Bio-Rad had proposed a construction for “releasably attached” that required the gel bead to be configured or designed to release the attached molecules. Order No. 22 at 22-23. The *Markman* order rejected Bio-Rad’s proposed construction for several reasons, including a discussion of the prosecution history where the applicants identified “reversible immobilization” as an example of releasable attachment. *Id.* at 26-27, 29. The discussion of reversible immobilization was cited an example to show that the claims “encompass[] situations wherein a barcode molecule is released from a bead by severing a portion of the barcode molecule,” *Id.* at 29, and nothing in the *Markman* order requires that every releasable attachment be reversible. Moreover, limiting “releasably attached” to reversible immobilization would be inconsistent with the claims of the ’024 patent, because dependent claim 15 adds “reversibly immobilized” as a limitation. *See Phillips*, 415 F.3d at 1315 (“[T]he presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.”). Bio-Rad’s proposed “reversible” limitation is not consistent with the claims, specification, or prosecution history of the ’024 patent.

There is no dispute with respect to the final element of the gel bead limitation, requiring that “said barcode sequences are the same sequence for said oligonucleotide molecules.”

Dr. Butte identifies documentation for ddSEQ v1 describing the same barcodes for each oligonucleotide in a bead. CX-0004C at Q/A 177-79. In particular, [REDACTED]

[REDACTED]

[REDACTED] CX-0149C.00019. Dr. Butte explains that for Bio-Rad’s products to perform their intended purpose, “the barcode sequence should be the same for all the oligonucleotide molecules on a gel bead.” CX-0004C at Q/A 180. [REDACTED]

[REDACTED]

JX-0091C.0009, .00011. In addition, Bio-Rad employee Dr. Lebofsky confirmed at his deposition that in the scATAC-seq assay, a single bead will have the same barcode on all of the single-stranded DNA fragments on it. CX-0018C at 208:11-15.

Accordingly, the accused ddSEQ v1 [REDACTED] processes infringe the “providing a droplet . . .” limitation of claim 1 of the ’024 patent.

b. “applying a stimulus . . .”

The second limitation of claim 1 of the ’024 patent requires “applying a stimulus to said porous gel bead to release said oligonucleotide molecules from said porous gel bead into said droplet.” Dr. Butte identifies the [REDACTED] as the claimed stimulus, which causes the release of the oligonucleotide molecules from the porous gel bead. CX-0004C at Q/A 181-83.

Bio-Rad argues that the accused products do not infringe this limitation because the [REDACTED] acts on the oligonucleotides, not the gel bead. RIB at 59-62. There is no dispute that the [REDACTED] acts on the oligonucleotide, but 10X and Staff argue that this is a distinction without a difference, because the oligonucleotide is part of the gel bead. CIB at 19-22; SIB at 29-31. For the reasons discussed below, I agree with 10X and Staff that a preponderance of the evidence shows that the [REDACTED] is applied to the gel bead in the accused products, and a stimulus that acts on the oligonucleotides attached to the gel bead is consistent with infringement of the “applying a stimulus” limitation.

Dr. Butte explains that the [REDACTED] is part of an aqueous solution that is applied to the gel bead in the accused products. CX-0004C at Q/A 184. One of Bio-Rad’s witness, Dr. Agresti, admitted at his deposition that “in ddSEQ, [] the [REDACTED] enters the entire volume of the bead.” CX-0009C at 343:12-13. As discussed above, the [REDACTED] [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED], releasing the oligonucleotide molecule. *Id.* There is no dispute that the [REDACTED] thus acts as the stimulus that releases the oligonucleotide molecule from the gel bead into the droplet.

Bio-Rad argues that the [REDACTED] is applied to the oligonucleotide, not the gel bead; but in the accused products, the oligonucleotides are part of the gel bead. Any stimulus applied to the oligonucleotide is therefore also applied to the gel bead. As Dr. Agresti admitted at the hearing, the oligonucleotides are “[i]nside the volume” of the beads. Tr. 289. *See also* CX-00011C (Frenz Dep. Tr.) at 59-60 (describing oligos “in the volume of the . . . bead.”). Bio-Rad cites the language of the ’024 patent to argue that the oligonucleotide molecules and gel beads are separately claimed structures, but the claim language explicitly describes the oligonucleotide molecules as a part of the gel beads: “said porous gel bead comprises at least about 1,000,000 oligonucleotide molecules.” *See* SIB at 30; SRB at 8. As stated in the *Markman* Order, “[t]he plain and ordinary meaning of ‘comprise’ is ‘to include esp. with a particular scope,’ ‘to be made up of,’ ‘compose,’ or ‘constitute.’” Order No. 22 at 17-18. Recognizing that the oligonucleotides are part of the gel beads is consistent with structure of the accused products and with the language of the asserted claims.

There is no dispute with respect to the remaining elements of this limitation. Dr. Butte identifies a target nucleic acid analyte in the ddSEQ v1 [REDACTED] “wherein upon release from said porous gel bead, a given oligonucleotide molecule from said oligonucleotide molecules attaches to said target nucleic acid analyte.” CX-0004C at Q/A 198 (ddSEQ v1: describing hybridization between the poly-T sequence of the oligonucleotide molecule and the

poly-A tail of the mRNA), Q/A 199 ([REDACTED]), Q/A 200 (scATAC-seq and [REDACTED]: Nextera adaptor binding sequence).

c. “. . . nucleic acid amplification”

The third and final limitation of claim 1 of the '024 patent requires “subjecting said given oligonucleotide molecule attached to said target nucleic acid analyte to nucleic acid amplification to yield a barcoded target nucleic acid analyte.” As discussed above, the term “amplification” was construed to mean “increasing the number of copies of the target sequence to be detected,” including by reverse transcription. Order No. 22 at 31-45.

10X relies on Dr. Butte’s analysis of reverse transcription in the accused products to show infringement of this limitation. CIB at 24-28. In the ddSEQ v1 products, Dr. Butte explains that an oligonucleotide molecule attached to mRNA is “subjected to reverse transcription, second strand synthesis, and further PCR, to yield a barcoded cDNA strand.” CX-0004C at Q/A 203. He further explains that barcoded cDNA strands are generated from the oligonucleotide molecules through several different processes, which 10X identifies in its brief as four types of amplification. CIB at 24-26 (citing CX-0004C at Q/A 205). In “Type A” the oligonucleotide-mRNA hybrids are subjected to reverse transcription to generate barcoded first cDNA strands. *Id.* In “Type B” the hybrids are subjected to second strand synthesis and further PCR to generate additional barcoded cDNA strands outside the droplet. *Id.* In “Type C” the oligonucleotide molecule attaches to the mRNA through reverse transcription to form the first barcoded cDNA strand, and this cDNA strand is subjected to second strand synthesis outside the droplet to create a second strand of cDNA. *Id.* In “Type D” the first cDNA strand is subjected

to PCR to generate additional double-stranded cDNA outside the droplet. *Id.* In Dr. Butte's opinion, any of these processes would meet the "amplification" limitation of the '024 patent.

Bio-Rad argues that the oligonucleotide molecule only acts as a primer during the reverse transcription reaction, and that this limitation is not infringed because the oligonucleotide molecule itself is not subjected to amplification. RIB at 62-63 (citing RX-0665C (Metzker RWS) at Q/A 87). This interpretation of the claim language was rejected in the *Markman* order, however, which recognized that persons of ordinary skill in the art would understand "amplification" to include reverse transcription. Order No. 22 at 32-41. Notably, the construction of "amplification" does not require exact copies of the oligonucleotide barcodes—the product of amplification can be complementary copies, which are the result of reverse transcription. *Id.* at 35-41. Moreover, dependent claims of the '024 patent explicitly discuss the usage of the oligonucleotide molecule as a primer during amplification. See '024 patent, claim 8 ("The method of claim 1, wherein said given oligonucleotide molecule of said oligonucleotide molecules comprises a region which functions as a primer during said nucleic acid amplification in c)."), claim 10 ("The method of claim 8, wherein said primer is configured to amplify said target nucleic acid analyte."). Bio-Rad's non-infringement argument is not consistent with the claim language of the '024 patent, as construed in this investigation.

Accordingly, the accused ddSEQ v1 [REDACTED] systems infringe all of the limitations of claim 1 of the '024 patent.

2. Dependent Claims

There is no dispute with respect to the infringement of any the limitations added by dependent claims 5, 17, 19, and 22 of the '024 patent.

Claim 5 requires that the stimulus that is applied to release the oligonucleotides "is

selected from the group consisting of a biological stimulus, a chemical stimulus, a thermal stimulus, an electrical stimulus, a magnetic stimulus, and a photo stimulus.” As discussed above, the [REDACTED] is the claimed stimulus in the accused products, and Dr. Butte explains that “[t]he [REDACTED] is both a biological stimulus and a chemical stimulus.” CX-0004C at Q/A 215.

Claim 17 requires that the claimed droplet “comprises a plurality of target nucleic acid analytes” and that “each of said plurality of target nucleic acid analytes attaches to an individual oligonucleotide molecule.” As discussed above, the ddSEQ v1, [REDACTED] [REDACTED] comprise a plurality of mRNAs, which attach to individual oligonucleotide molecules through hybridization and reverse transcription. *See* CX-0004C (Butte DWS) at Q/A 219-20. The droplets in the scATAC-seq [REDACTED] comprise a plurality of genomic DNA fragments, which attach to individual oligonucleotide molecules through hybridization involving the Nextera Adaptor binding sequence. *Id.*

These processes also infringe the limitations of claim 19, which requires that “said given oligonucleotide molecule from said oligonucleotide molecules attaches to said target nucleic acid analyte by hybridization.” *See* CX-0004C (Butte DWS) at Q/A 223.

There is no dispute that the ddSEQ system infringes the limitations of claim 22, which requires that the “porous gel bead comprises a polymer gel” and “said polymer gel is a polyacrylamide.” *See* CX-0004C (Butte DWS) at Q/A 224-26.

Accordingly, the accused ddSEQ v1 [REDACTED] infringe dependent claims 5, 17, 19, and 22 of the '024 patent.

3. Indirect Infringement

The asserted claims of the '024 patent are method claims, and 10X contends that there is

a violation of section 337 by Bio-Rad based on theories of contributory and induced infringement. CIB at 30-37.

a. Underlying Direct Infringement

Indirect infringement requires evidence of an underlying direct infringement. As discussed above, ordinary use of the ddSEQ products would be direct infringement of the asserted claims of the '024 patent by Bio-Rad's customers. *See* CIB at 31-32. There is no dispute that Bio-Rad's customers have used and continue to use the ddSEQ v1 products in the United States. *Id.*; SIB at 36. In particular, 10X cites evidence that by early 2017, Bio-Rad had engaged with [REDACTED] of ddSEQ v1 products. CX-0004C (Butte DWS) at Q/A 599; CX-1494C; CX-1584C. Dr. Kaihara testified at her deposition that she has helped many Bio-Rad customers use the ddSEQ v1 system, including several in the United States. CX-0016C at 48-49; *see* Tr. 270. Bio-Rad's corporate representatives confirmed that Bio-Rad had sold [REDACTED] to its customers. CX-0019C (Reifsnyder Dep. Tr.) at 70-71; CX-0020C (Norton Dep. Tr.) at 32-33. This evidence is sufficient to show direct infringement of the '024 patent by Bio-Rad's customers.

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] 10X contends that

[REDACTED]
[REDACTED]

Dr. Kaihara's testimony is sufficient to show direct infringement by [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

b. Induced Infringement

Bio-Rad admits that it had knowledge of the application for the '024 patent [REDACTED], CX-0050C at 8, and the complaint in this investigation explicitly accused Bio-Rad of induced infringement. Complaint ¶ 72; *see Certain Television Sets, Television Receivers, Television Tuners, and Components Thereof*, Inv. No. 337-TA-910, Comm'n Op. at 39-43 (Oct. 14, 2015) (holding that service of the complaint on a respondent is sufficient to establish knowledge for indirect infringement). 10X identifies Bio-Rad's promotional materials and instruction manuals as evidence that Bio-Rad has induced infringement of the asserted claims. CIB at 36-37. This includes advertising materials, instructional manuals, and materials describing Bio-Rad's customer support and services for installation, repair, and troubleshooting of ddSEQ products. *See* CX-0004C (Butte DWS) at Q/A 629-37. Bio-Rad does not dispute this evidence of inducement, and Staff agrees with 10X that the dissemination of these materials is sufficient to show that Bio-Rad has induced infringement of the asserted claims of the '024 patent by the ddSEQ v1 products. SIB at 39-40.

Accordingly, 10X has shown that Bio-Rad has induced infringement of claims 1, 5, 17, 19, and 22 of the '024 patent by the ddSEQ v1 products.

c. Contributory Infringement

As discussed above, Bio-Rad had knowledge of its contributory infringement upon service of the complaint in this investigation. *See* Complaint ¶ 73 (alleging contributory infringement). Dr. Butte explained how the accused components of Bio-Rad's ddSEQ system are especially adapted for use in practicing the infringing methods. CX-0004C at Q/A 602-609. With respect to the ddSEQ v1 products, Dr. Butte identifies specific components, including the ddSEQ cartridges, ddSEQ single-cell isolator, ddSEQ cartridge holder, and consumables and assays used with the ddSEQ v1 process, including the SureCell WTA 3' v1 assay, which are designed and adapted for performing the infringing ddSEQ v1 workflow. *Id.* at Q/A 604. These components and their use in the ddSEQ v1 system are described in Bio-Rad product literature, including a [REDACTED] presentation (JX-0088C), and numerous instruction manuals and training materials. *See, e.g.,* CX-1405C; CX-1406C; CX-1435C; CX-1436C; CX-1460C; CX-1437C; CX-1451C; CX-1452C; CX-1454C; CX-1461C; CX-1473C; CX-1488C. Dr. Butte also identifies [REDACTED]. *Id.* at Q/A 605-609.

Bio-Rad disputes 10X's allegations of contributory infringement by arguing that the ddSEQ v1 system has a substantial non-infringing use. RIB at 66-68. Specifically, Dr. Metzker describes the Drop-seq protocol, where the barcode molecules are not releasably attached to the gel bead and are not released, as required by the claims of the '024 patent. RX-0665C at Q/A 138-143. During the course of this investigation, Bio-Rad developed a Drop-seq protocol for its ddSEQ system, releasing the protocol to the public in late 2018. *Id.* at Q/A 144-147; JX-0131C; JX-0130; *see* Tr. (Kaihara) at 239.

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10X does not dispute that Drop-seq would be a non-infringing use of the ddSEQ system, but 10X and Staff argue that it is not a “substantial non-infringing use,” because there is no evidence that any ddSEQ user has actually used the Drop-seq protocol. CIB at 34-35; SIB at 37-38. The Bio-Rad employee who was responsible for updating the Drop-seq protocol admitted at the hearing that she was not aware of any customer using Drop-seq on any Bio-Rad ddSEQ device. Tr. (Kaihara) at 240-41. Bio-Rad did not publish the Drop-seq protocol for ddSEQ until after the close of discovery in this investigation. *Id.* at 239. Dr. Butte considered the evidence regarding Bio-Rad’s Drop-seq protocol and offered his opinion that it would not be a substantial use of the ddSEQ products because it would require additional reagents not included in the ddSEQ products, and it would not use several of the accused ddSEQ components, including Bio-Rad’s SureCell kits and certain assays. CX-0004C at Q/A 611-616. Based on this evidence, I agree with 10X and Staff that the Drop-seq protocol is not a substantial non-infringing use of the ddSEQ system, and accordingly, 10X has carried its burden to show contributory infringement with respect to the accused ddSEQ v1 products. *See Certain Beverage Brewing Capsules, Components Thereof, and Products Containing the Same*, Inv. No. 337-TA-929, Comm’n Op. at 22-24 (Apr. 5, 2016) (finding contributory infringement based on a lack of substantial non-infringing uses).

Accordingly, 10X has shown that Bio-Rad contributorily infringed of claims 1, 5, 17, 19, and 22 of the ’024 patent by importing and selling components of the ddSEQ v1 system.

D. Domestic Industry

There is no dispute that 10X’s DI products practice claims 1, 5, 17, 19, and 22 of the ’024 patent. CIB at 37-40; SIB at 40-41. 10X relies on the testimony of Dr. Butte to show that the DI products practice the asserted claims. CX-0004C at Q/A 227-287.

1. Claim 1

10X's DI products are part of a method of sample preparation of gDNA or mRNA for sequencing applications. CX-0004C (Butte DWS) at Q/A 256-58. The steps in the method meet each of the limitations of claim 1 of the '024 patent. *Id.* at Q/A 259-79. In particular, 10X's DI products provide a droplet that contains a porous gel bead formed of polyacrylamide. *Id.* at Q/A 260-61. 10X's single cell applications contain an mRNA as a target nucleic acid analyte, while the linked read solutions contain a gDNA fragment. *Id.* In each of the DI products, there are at least 1,000,000 oligonucleotide molecules that include barcode sequences. *Id.* at Q/A 263-64. These barcode sequences are the same for the oligonucleotide molecules on each gel bead. *Id.* at Q/A 269-70. The oligonucleotide molecules are releasably attached to the gel bead through a [REDACTED] that can be broken upon application of [REDACTED]. *Id.* at Q/A 265-68. [REDACTED] is applied to the gel bead as part of "Additive A," which cleaves the [REDACTED] to release the barcodes and also dissolves the gel bead. *Id.* at Q/A 272-73. Upon release, the barcodes attach through hybridization to the mRNA or gDNA fragment. *Id.* at Q/A 274-76. In the single-cell applications, a reverse transcription process then generates barcoded cDNA strands, which undergo further PCR outside the droplet to create barcoded double-stranded cDNAs. *Id.* at Q/A 278. In the linked-read applications, an isothermal amplification in the droplet creates a DNA amplicon, which undergoes further amplification outside the droplet. *Id.* at Q/A 279.

Accordingly, the DI products meet the technical prong of the domestic industry requirement with respect to claim 1 of the '024 patent.

2. Dependent Claims

The additional limitations of the asserted dependent claims are also practiced by the DI products. With respect to claim 5, [REDACTED]. CX-0004C (Butte DWS) at Q/A

281. With respect to claim 17, the mRNA of the single-cell applications and the gDNA of the linked-read applications are the target nucleic acid analytes, and they attach to individual oligonucleotide molecules in each of the DI products. *Id.* at Q/A 283. With respect to claim 19, the oligonucleotides attach to the mRNA or gDNA fragment through hybridization. *See Id.* at Q/A 274-76. With respect to claim 22, the porous gel beads of the DI products are comprised of polyacrylamide. *Id.* at Q/A 287.

Accordingly, the DI products meet the technical prong of the domestic industry requirement with respect to dependent claims 5, 17, 19, and 22 of the '024 patent.

E. Invalidity

Bio-Rad contends that the asserted claims of the '024 patent are invalid as anticipated or rendered obvious by U.S. Patent No. 9,347,059 (JX-0031, "the '059 patent") and/or U.S. Patent No. 9,902,950 (RX-0462, "Church"), alone or in combination with additional prior art. RIB at 68-111.

1. The '059 patent

The '059 patent issued from a patent application filed by Bio-Rad in April 2012, based on a provisional application that was filed in April 2011 by Dr. Saxonov, around the time that QuantaLife was acquired by Bio-Rad. CX-1829C (Saxonov RWS) at Q/A 25-27; JX-0031. Dr. Saxonov is the sole named inventor on the '059 patent, and Bio-Rad is the assignee. JX-0031. There is no dispute that the '059 patent is prior art to the '024 patent and all of the other asserted patents—it is listed as a cited reference on each of the asserted patents. *See* SIB at 41.

The '059 patent discloses methods for barcoding mRNA and DNA in droplets. The specification of the '059 patent explains the benefits of barcoding, allowing separately prepared samples to be pooled and sequenced, while "each sample can have its own unique barcode."

'059 patent, col. 3:53-62. The specification further describes “adaptors” with barcodes that “can be bundled within a partition, e.g., an aqueous phase of an emulsion, e.g. a droplet.” *Id.*, col. 4:4-5. Also, “[t]he adaptor-filled droplets can be burst (e.g., through a temperature adjustment) to release reaction components” *Id.*, col. 4:34-37. The specification also describes “end modifications” that “can be attached to a nucleic acid strand through a linker.” *Id.*, col. 12:30-36. Moreover, the specification describes “an amplification reaction” that “comprises a polymerase chain reaction.” *Id.*, col. 2:41-46. The specification further provides that “[a] barcode can be attached to a polynucleotide by amplification with a primer comprising a barcode.” *Id.* at col. 9:63-65.

There is no dispute that many of the limitations of the asserted claims of the '024 patent are disclosed in the '059 patent. In particular, the '059 patent discloses a method for sample preparation using a droplet containing barcoded oligonucleotide molecules and that the oligonucleotide molecules are subject to amplification. The parties dispute whether the '059 patent discloses several specific claim limitations, however, including the limitations regarding porous gel beads, and the limitations requiring releasable attachment to those beads.

a. Porous gel beads

10X and Staff argue that the '059 patent fails to disclose the porous gel beads claimed in the '024 patent. CIB at 62-75; SIB at 42-44. Bio-Rad concedes that there is no explicit disclosure of porous gel beads in the '059 patent specification. RRB at 20-21. Bio-Rad points to an embodiment described in the '059 patent where barcodes attach to a bead: “In some embodiments, antibodies can be linked to beads coated with short DNA fragments with a unique barcode.” '059 patent, col. 36:59-60. Although the '059 patent does not describe the type of bead used with these antibodies, the use of the term “coated” suggests that the barcodes are

attached to the surface of a solid bead, rather than the interior of a porous bead. *See* CX-1872C (Dear RWS) at Q/A 108 (“Not only are the antibody-linked beads not being described as gel or porous, they are described as being ‘coated’ with short DNA fragments. Thus, the beads are not permeated with oligonucleotide molecules, and instead their surface is “coated.” This further confirms that the beads are not porous gel beads, and are instead rigid, non-porous beads.”); CX-1829C (Saxonov RWS) at Q/A 16 (“I was assuming that the beads were solid throughout or that only the exterior solid surface was going to be used.”). Bio-Rad identifies an alleged reference to gel beads in another embodiment in the ’059 patent specification describing a “next generation sequencing technique” called Roche 454 sequencing. ’059 patent, col. 26:43-66. Dr. Metzker explains that the Roche 454 system used Sepharose beads, which he describes as porous gel beads. RX-0664C at Q/A 162-63, 166-68.

10X disputes Bio-Rad’s assertion that the Roche 454 beads are porous gel beads as required by the claims of the ’024 patent. CIB at 64-75. Although Dr. Metzker identifies the Roche 454 beads as Sepharose, there is no direct evidence in the record of the composition of these beads.⁵ The only evidence that Bio-Rad cites is cross-examination testimony of 10X’s expert, Dr. Dear, who identified a publication by Marcel Margulies *et al.* (CX-1940) describing the use of Sepharose beads in the context of Roche 454 sequencing: “Yes, I believe—at the time 454 published, I believe they used sepharose beads. That’s the Margulies paper. Whether they did since in their commercial instruments, I don’t know.” Tr. 869-70.

10X also challenges Bio-Rad’s assertion that Sepharose is a porous gel, relying on the opinion of Dr. Dear that Sepharose beads are rigid and lack the deformability that characterizes

⁵ Certain evidence regarding Sepharose beads was excluded from Dr. Metzker’s witness statement pursuant to a motion *in limine*. Order No. 38 at 8-9 (Mar. 12, 2019).

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the gel beads described in the asserted patents. CIB at 64-75 (citing CX-1827C (Dear RWS) at Q/A 110-15). Bio-Rad supports its contention that Sepharose is a porous gel with testimony from Dr. Agresti, who describes Sepharose as “a crosslinked agarose, which is a material that I would consider to be a hydrogel,” citing a document listing Sepharose as a “gel filtration media.” RX-0503C (Agresti DWS) at Q/A 69; RX-0692. During cross-examination, however, Dr. Agresti admitted that gel filtration is different from microfluidics. Tr. 336. In addition, Dr. Agresti had previously testified at his deposition that he was not sure whether prior art using Sepharose would disclose a hydrogel bead. *Id.* at Q/A 66-68; Tr. 334.⁶ Bio-Rad also offers testimony from Dr. Grenier describing Sepharose as a porous gel bead based on his work in graduate school in the mid-1990s. RX-0507C at Q/A 47-50.

Although I agree with Bio-Rad that Dr. Dear’s strict requirements for rigidity and deformability may not be necessary to satisfy the “porous gel bead” limitation, Bio-Rad bears the burden on invalidity, and the conflicting evidence regarding Sepharose is neither clear nor convincing. Even if Bio-Rad had shown that Sepharose beads existed in the prior art that were porous gel beads, the record is far from clear that such beads were used in the Roche 454 sequencing process described in the ’059 patent. Bio-Rad does not identify any disclosure in the ’059 patent or the Margulies paper describing the composition or the characteristics of the Roche 454 beads, and Bio-Rad’s witness testimony does not convincingly show that these beads described in the ’059 patent are porous gel beads. Accordingly, Bio-Rad has failed to carry its

⁶ Dr. Agresti equivocated on this issue when he was presented with a document filed at the USPTO by Bio-Rad’s counsel when prosecuting a different patent application, which is discussed in more detail, *infra*, in the context of the Church patent. JX-0171.0027.

burden to show that the porous gel bead limitation of the '024 patent is anticipated by disclosures in the '059 patent.

b. Releasable attachment

Even if Bio-Rad had presented sufficient evidence at the hearing to show that the '059 patent disclosed porous gel beads, the beads identified by Dr. Metzker cannot anticipate the limitation of claim 1 of the '024 patent requiring that “said oligonucleotide molecules are releasably attached to said porous gel bead.” 10X’s expert, Dr. Dear, notes that the '059 patent describes the Roche 454 beads as “capture beads,” and these beads are only discussed in the context of sequencing, which is a separate process in a separate embodiment from any discussion of releasing barcodes. CX-1827C at Q/A 87, 108. The '059 patent only references the Roche 454 beads as a substrate for sequencing, and Dr. Dear explains that “nucleic acids to be sequenced must remain attached to the substrate for their sequences to be determined.” *Id.* at Q/A 108. Bio-Rad fails to connect the '059 patent’s disclosure of Roche 454 beads to any discussion of releasable attachment, and the '059 patent’s separate disclosure of these beads cannot form the basis for a finding of anticipation of this limitation. *See Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (holding that the district court was “wrong to combine parts of the separate protocols shown in the iKP reference in concluding that claim 23 was anticipated”).

Bio-Rad argues in the alternative that it would have been obvious to use porous gel beads for releasable attachment of the oligonucleotides described in the '059 patent. *See* RRB at 20-21. Dr. Metzker identifies the '059 patent’s disclosure of antibody-linked beads and droplets as a disclosure of releasable attachment. RX-0664C at Q/A 181-85. In particular, the '059 patent specification describes an embodiment where “antibodies can be linked to beads coated with

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short DNA fragments with a unique barcode,” and further suggests that “[t]he antibodies could also be linked to droplets containing DNA fragments—which can be burst as appropriate.” JX-0031, col. 36:59-64. Based on this disclosure, Dr. Metzker suggests that the ’059 patent “teaches three interchangeable ways to deliver barcodes—droplets, capsules, and beads.” RX-0664C at Q/A 181.

10X argues that Bio-Rad improperly mixes and matches different embodiments of the ’059 patent. CIB at 53-64. The portion of the ’059 specification that describes the release of “barcode adaptors” is limited to droplets, disclosing that “[t]he adaptor-filled droplets can be burst (e.g., through a temperature adjustment) to release reaction components (e.g., PCR or ligation components) that can be used for library preparation.” JX-0031, col. 4:34-37. The antibody-linked beads are described in a separate embodiment, and the DNA fragments attached to these beads are not the barcodes described in the ’059 patent’s droplet embodiment. *See* CX-1827C (Dear RWS) at Q/A 40, 87. Moreover, although the ’059 patent describes the droplets being “burst” to release barcode adaptors, there is no description of any mechanism for releasing the attached DNA fragments from beads. *Id.* at Q/A 155-56. Dr. Metzker concedes that the antibody-linked embodiment does not disclose the claimed barcodes but submits that “one of ordinary skill in the art would have immediately envisioned from the bead antibody disclosure in Saxonov that it could also apply to barcoding the cellular material.” RX-0664C at Q/A 183. Dr. Metzker’s suggestion that the antibody-linked DNA fragments could be replaced with barcodes is plausible, but this would only result in barcodes attached to beads, with no teaching regarding release.

To meet the releasable attachment limitation, Dr. Metzker further suggests that “[t]he only way for the barcodes in the inner droplet to function is by having them released from the

inner droplet,” and “[o]ne of ordinary skill in the art would have therefore recognized that the barcodes on beads would be functioning in the same way, they would be released from the bead.” *Id.* at Q/A 184. There is no disclosure in the ’059 patent indicating how the beads could function to release barcodes in the same way as the burstable droplets, however, and Bio-Rad fails to offer a convincing argument for how one of ordinary skill in the art would use prior art teachings to replace the burstable droplets with beads. As Dr. Dear explains, the ’059 patent specification shows that “although Saxonov specifically had the idea of releasing adaptors from a droplet,” he “did not have the idea of releasing short DNA fragments from a bead.” CX-1827C at Q/A 161.

Dr. Metzker attempts to supply a mechanism for releasably attaching barcodes to beads by suggesting that one of ordinary skill in the art would recognize that certain parts of the barcodes disclosed in the ’059 patent “would be susceptible to cleavage and could remove the barcode adaptor molecule at the point of contact with the bead.” RX-0664C at Q/A 186. This conclusory expert opinion cannot meet Bio-Rad’s burden on invalidity, however. *See K/S Himpp v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365-66 (Fed. Cir. 2014) (affirming a finding of non-obviousness where the USPTO properly rejected “a conclusory assertion from a third party about general knowledge in the art without evidence on the record,” noting that the limitation “an important structural limitation that is not evidently and indisputably within the common knowledge of those skilled in the art”). Dr. Metzker’s suggestion for barcode cleavage is not based in any prior art disclosure but on hindsight, using the limitations of the ’024 patent to selectively modify the prior art. *See Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc.*, 520 F.3d 1358, 1364 (Fed. Cir. 2008) (“In other words, Mylan’s expert, Dr. Anderson, simply retraced the path of the inventor with hindsight, discounted the number and complexity of the alternatives,

and concluded that the invention [] was obvious. Of course, this reasoning is always inappropriate for an obviousness test . . .”).

Accordingly, I agree with 10X and Staff that Bio-Rad has failed to show that releasably attaching oligonucleotide molecules to a bead would be obvious in view of the '059 patent.

c. Combinations with other references

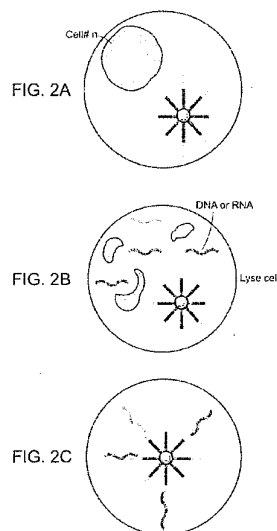
Bio-Rad further contends that the claimed porous gel beads are disclosed in other prior art references that would have been obvious to combine with the '059 patent. RIB at 77-80. These references include the Church patent (RX-0462), an article by Dr. Adam Abate, *Beating Poisson Encapsulation Statistics Using Close-Packed Ordering* (RX-0102, “Abate”), and U.S. Patent Application Pub. No. 2010/0304982, naming inventors Wolfgang Hinz *et al.* (RX-0461, “Hinz”). These references each disclose beads that appear to meet the “porous gel bead” limitations of the asserted claims of the '024 patent, but Bio-Rad fails to offer any credible motivation for combining the gel beads disclosed in these references with the droplet-based barcoding system disclosed in the '059 patent. As discussed above, Dr. Metzker’s proposal for replacing the '059 patent’s burstable droplets with beads having releasably attached barcodes is conclusory and relies on hindsight. Bio-Rad has identified no credible motivation for one of ordinary skill in the art to look to the gel beads disclosed in Church, Abate, or Hinz for releasable attachment of the barcodes contained in droplets in the '059 patent. Accordingly, Bio-Rad has failed to show that any asserted claim of the '024 patent is rendered obvious by the '059 patent in combination with these additional references.

2. The Church patent

The Church patent issued from a patent application filed in October 2011 and is assigned to Harvard College. RX-0462. There is no dispute that the Church patent is prior art to the '024

patent and all of the other asserted patents—the published patent application for the Church patent is listed as a cited reference on each of the asserted patents. *See* SIB at 50-51.

Church describes a process for producing beads coated with barcoded oligonucleotides. RX-0462, col. 2:28-34. The specification explicitly discloses “a variety of materials” for its beads, including “paramagnetic materials, ceramic, plastic, glass, polystyrene, methylstyrene, acrylic polymers, titanium, latex, sepharose, cellulose, nylon and the like.” *Id.*, col. 12:38-42. Figure 2 of Church depicts a process where a single cell and barcoded bead are captured in an emulsion (Fig. 2A), nucleic acid sequences are released into the emulsion upon cell lysis (Fig. 2B), and the nucleic acid target is annealed to the barcoded bead (Fig. 2C).



Id. at Fig. 2, col. 3:49-53, col 5:50-6:10. The barcoded beads are then further processed, with cDNA synthesis for RNA, followed by PCR amplification. *Id.*, col. 6:18-24.

There is no dispute that the Church patent discloses a method for sample preparation using a barcoded bead with oligonucleotides attached that are subject to amplification. The parties dispute whether Church discloses several limitations of the asserted claims of the '024

patent, however, including whether the bead is a porous gel bead and whether the barcoded oligonucleotides are releasably attached.

a. Porous gel beads

Bio-Rad primarily relies on the Church patent's disclosure of Sepharose beads to anticipate the porous gel bead limitation of the '024 patent. RIB at 95-96. As discussed above in the context of the '059 patent, Bio-Rad relies on the testimony of Dr. Metzker and certain other evidence that Sepharose beads are porous gel beads. RX-0664C (Metzker DWS) at Q/A 213; *see also* RX-0503C (Agresti DWS) at Q/A 66-69; RX-0507C (Grenier DWS) at Q/A 47-50. 10X's expert, Dr. Dear, disagrees with Dr. Metzker's opinion, contending that Sepharose beads are rigid and lack the deformability to meet the gel bead limitation. CX-1827C (Dear RWS) at Q/A 110-115. Moreover, Bio-Rad's counsel represented to the USPTO in August 2017 that "Church does not teach or suggest particles that are hydrogels nor cleaving the oligonucleotides from the particles as recited in the claims." JX-0171.0027, Applicant's Response to Final Office Action at 8 (Aug. 21, 2017).⁷ On this record, Bio-Rad has failed to carry its clear and convincing burden to show that Church's disclosure of Sepharose as a bead material anticipates the claim limitation requiring a porous gel bead.

Bio-Rad further contends that Church's disclosure of cellulose and polystyrene as bead materials anticipates the porous gel bead limitation. RIB at 95-96. Bio-Rad offers little evidence to support these assertions, however. With respect to cellulose, Bio-Rad cites cross-examination testimony from Dr. Dear, where he was presented with a catalog describing cellulose as having

⁷ Bio-Rad later filed a correction with USPTO withdrawing this statement, conforming their prosecution filings to their arguments here that "Sepharose is a cross-linked agarose with a porous structure and is a hydrogel." RX-0660 at 9.

porosity, but Dr. Dear testifies that “I’m familiar with cellulose in the ordinary sense of the word, and as I know it, it’s – as I have encountered it, it’s nonporous and rigid.” Tr. 890-91. For polystyrene, Bio-Rad cites testimony from Dr. Metzker that “[p]olystyrene can be cross-linked” and that “there are only two choices . . . of going with either a nonporous or a porous polystyrene bead.” Tr. 676-77. This expert testimony, without additional evidentiary support, is insufficient to meet Bio-Rad’s clear and convincing burden, particularly when considered in the context of Bio-Rad’s prior representation to the USPTO that “Church does not teach or suggest particles that are hydrogels.” JX-0171.0027.

Accordingly, the porous gel bead limitations of the ’024 patent are not anticipated by the Church patent.

b. Releasable attachment

With respect to the releasable attachment limitations of the ’024 patent, Bio-Rad points to a paragraph in the Church patent’s specification describing “functional groups attached to [a bead] surface, which can be used to bind one or more reagents described herein to the bead.” RX-0462, col. 12:43-53. Church further states: “One or more reagents can be attached to a support (e.g., a bead) by hybridization, covalent attachment, magnetic attachment, affinity attachment and the like.” *Id.* Church then references “a variety of attachments” that “are commercially available” and states that beads “may also be functionalized using, for example, solid-phase chemistries known in the art,” citing another patent, U.S. Patent No. 5,919,523 to Sundberg, *et al.* (RX-0466, “Sundberg”). *Id.*

According to Dr. Metzker, Sundberg “teaches the attachment of oligonucleotides to porous gel bead surfaces for the synthesis of oligonucleotides using spacer molecules.” RX-0664C at Q/A 222. Sundberg provides that “[i]n some embodiments, the spacer may provide for

a cleavable function by way of, for example, exposure to acid or base.” RX-0466, col. 8:57-59.

In addition, “[a]ccording to other embodiments, small beads may be provided on the surface, and compounds synthesized thereon may be released upon completion of the synthesis. *Id.*, col.

6:14-16. Based on these disclosures, Bio-Rad argues that the releasable attachment limitation of the ’024 patent is rendered obvious by Church, incorporating Sundberg by reference. RIB at 100-102; RRB at 30-34.⁸

10X and Staff disagree with Bio-Rad’s contention, arguing that Sundberg is only cited by Church in the context of attaching functional groups to bind reagents to beads, without any discussion of releasing barcodes. CIB at 95-96; SRB at 19-20; *see* CX-1927C (Dear RWS) at Q/A 286. Moreover, the disclosures in Sundberg relied upon by Dr. Metzker are found under the heading “Pin-Based Methods,” which is separate from “Bead Based Methods.” *See* RX-0466, col. 8:23-59, 8:60-13:49. As Dr. Dear explains, the pin-based methods in Sundberg are methods of synthesis where “[e]ach tray is filled with a particular reagent for coupling in a particular chemical reaction on an individual pin.” CX-1827C at Q/A 289 (quoting RX-0466, col. 8:33-34). According to Dr. Dear, the “cleavable function” cited by Dr. Metzker relates to the removal of a substance synthesized on a pin, not the release of barcodes attached to a bead. *Id.* Dr. Dear also notes that where Sundberg references release in the context of beads, it describes release “upon completion of the synthesis,” which is not a release of barcodes into a droplet, as claimed

⁸ It is unclear from Bio-Rad’s post-hearing briefs whether it contends that this limitation is anticipated by the Church patent. Bio-Rad’s initial post-hearing brief contains a section heading stating that “Church anticipates or renders obvious the claims of the ’024 Patent.” RIB at 94; *see also id.* at 106. Nevertheless, Bio-Rad does not appear to make an explicit contention that Church anticipates the “releasably attached” limitation of the ’024 patent, *see* RIB at 100-102, and in Bio-Rad’s post-hearing reply brief, Bio-Rad only contends that Church renders the asserted claims obvious. RRB at 30-34.

in the '024 patent. *Id.* Moreover, there is nothing in Church to suggest that one of ordinary skill would look to Sundberg for methods of releasing barcodes, because Church only describes a process where the barcodes remain attached to the bead. *Id.* These are significant gaps in Dr. Metzker's analysis that undercut Bio-Rad's obviousness contentions.

Bio-Rad's contentions are further contradicted by the representation of its attorneys to the USPTO that "Church does not teach or suggest particles that are hydrogels nor cleaving the oligonucleotides from the particles as recited in the claims." JX-0171.0027, Applicant's Response to Final Office Action at 8 (Aug. 21, 2017).⁹ On this record, I agree with 10X and Staff that Bio-Rad has failed to show that the "releaseably attached" limitation is obvious in view of Church and Sundberg.

c. Combination with other references

Bio-Rad further contends that the asserted claims of the '024 patent are obvious in view of Church in combination with several additional references. RIB at 94-111; RRB at 30-34.

I agree with Bio-Rad that the use of a porous gel bead would have been obvious in view of Church in combination with Sundberg or Hinz (RX-0461). The list of bead materials in Church is non-exhaustive. RX-0462, col. 12:38-42 ("Beads may comprise a variety of materials including, but not limited to paramagnetic materials, ceramic, plastic, glass, polystyrene, methylstyrene, acrylic polymers, titanium, latex, sepharose, cellulose, nylon and the like."). Sundberg explicitly describes "polymer-coated supports" including "polyacrylamides." RX-0466, col. 5:32-38. Hinz teaches using polyacrylamide gel beads for nucleic acid analysis,

⁹ Although Bio-Rad later retracted its argument regarding hydrogels, *see* n.7, *supra*, there has been no retraction of its statement reading cleaving the oligonucleotides. Bio-Rad submits that it amended the pending claims, however, to remove a limitation regarding cleaving the oligonucleotides. RRB at 33 (citing RX-0660.0005).

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noting that these porous gel beads “allow polynucleotides to be attached throughout their volumes for higher loading capacities than those achievable solely with surface attachment.” RX-0461, Abstract. Polyacrylamide is explicitly identified in the ’024 patent specification and claims as a polymer gel that can be used for a porous gel bead. ’024 patent, col. 1:51-53, 2:28-31. In addition, Dr. Dear agreed that Hinz discusses porous gel beads. Tr. 895-96. Accordingly, I agree with Bio-Rad that one of ordinary skill in the art, reading the statement in Church identifying a variety of bead materials, would have pursued other known materials available in the prior art, including the polyacrylamide beads described in Sundberg and Hinz. As recognized by Dr. Metzker, one of ordinary skill in the art would have been motivated to use these porous gel beads because of their increased loading capacities, consistent with the Church patent’s stated goals of generating millions of barcoded beads for high-throughput sequencing. See RX-0664C at Q/A 216; RX-0462, col. 2:30-34, 2:51-3:6.

Bio-Rad has failed to make its case for obviousness with respect to the “releasably attached” limitation, however. Bio-Rad contends that it would have been obvious to use releasable attachments to the beads in Church when viewed in combination with the ’059 patent, Sundberg, and the knowledge of one of ordinary skill in the art. RIB at 100-102; RRB at 30-34. Bio-Rad identifies no motivation for adding releasability of barcodes to the process disclosed in Church, however. As discussed above, Bio-Rad’s attorneys argued to the USPTO that “Church does not teach or suggest . . . cleaving the oligonucleotides from the particles as recited in the claims.” JX-0171.0027. Bio-Rad fails to identify any evidence in Church to contradict this prior representation.

Bio-Rad argues that the releasably attached limitation is obvious because there are only two options for the barcodes attached to the beads in Church: either the barcode remains attached

to the bead or it is detached. RRB at 32-33. Bio-Rad's argument relies on a misreading of *KSR*, however, which describes a case for obviousness where there is "a design need or market pressure to solve a problem," and one of ordinary skill would have "good reason to pursue the known options within his or her technical grasp." 550 U.S. at 421. Whether or not to release barcodes attached to bead does not present a choice of two solutions to a known problem, however—these are two methods for addressing different problems in the prior art. In *Church*, the problem is attaching barcodes to a bead, and these barcodes remain attached to the bead for synthesis and amplification. RX-0462, col. 6:18-24. In the '059 patent, droplets are burst to release reaction components with the barcodes. JX-0031, col. 4:34-36. Bio-Rad's framing of the issue as two known options has been constructed in hindsight, and it does not prove that this limitation is obvious. *See* CRB at 37-38.¹⁰

Accordingly, Bio-Rad has failed to show that any asserted claim of the '024 patent is rendered obvious by *Church* in combination with any of these additional references.

3. Secondary considerations of non-obviousness

In *Graham v. John Deere Co. of Kansas City*, the Supreme Court held that in determining obviousness "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, *etc.*, might be utilized" as "*indicia* of obviousness or nonobviousness," 383 U.S. 1, 17-18 (1966). Indeed, "evidence of secondary considerations may often be the most probative and cogent evidence in the record." *In re Cyclobenzaprine Hydrochloride Extended-*

¹⁰ At the hearing, Dr. Dear testified: "No, there's not only two options as to what you do. If you say do—I mean, there are many things you can do in droplets. If you simply say do we cleave it off the bead or do we not cleave it off the bead, the point I'm making is that that doesn't constitute a conception. It's just saying those are two options for that particular feature." Tr. 912:3-13.

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Release Capsule Patent Litigation, 676 F.3d 1063, 1075-76 (Fed. Cir. 2012) (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538-39 (Fed. Cir. 1983)) (internal quotation marks omitted). Accordingly, such evidence “must always when present be considered *en route* to a determination of obviousness.” *Id.* (quoting *Stratoflex*, 713 F.2d at 1538-39) (internal quotation marks omitted). Secondary considerations of non-obviousness “include: commercial success enjoyed by devices practicing the patented invention, industry praise for the patented invention, copying by others, and the existence of a long-felt but unsatisfied need for the invention.” *Apple Inc. v. Samsung Electronics Co.*, 839 F.3d 1034, 1052 (Fed. Cir. 2016).

10X identifies five secondary considerations that it alleges weigh against a finding of obviousness. Four of these considerations—(1) solving a long-felt need, (2) industry praise, (3) commercial success, and (4) failure of others—relate to the success of 10X’s domestic industry products and the failure of a competitor to develop a competing product. With regard to these secondary considerations, Bio-Rad argues that 10X has not shown a nexus between the asserted claims and the domestic industry products. RRB at 94-95. With respect to the fifth secondary consideration identified by 10X—copying by another, *viz.*, Bio-Rad—Bio-Rad contests 10X’s allegations of copying.

a. The success of the domestic industry products weighs against obviousness.

i. 10X has established the required nexus.

There must be a “nexus between the merits of the claimed invention and evidence of secondary considerations . . . in order for the evidence to be given substantial weight in an obviousness decision.” *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 668 (Fed. Cir. 2000)); *see also Ormco Corp v. Align Tech., Inc.*, 463 F.3d 1299, 1311-12 (Fed. Cir. 2006) (“Evidence of commercial success, or other secondary considerations, is only significant if there is a nexus

between the claimed invention and the commercial success.”). As discussed herein, the domestic industry single-cell products practice all of the asserted patents, while the domestic industry linked-read products practice the asserted claims of the ’024, ’468, and ’204 patents. Citing *WBIP, LLC v. Kohler Co.*, both 10X and Staff argue that the domestic industry products’ practice of the asserted claims triggers a presumption that there is a nexus between the claims and the “asserted objective evidence” tied to the domestic industry products. 829 F.3d 1317, 1329 (Fed. Cir. 2016) (internal citations and quotation marks omitted). Such a presumption is only applicable, however, if a product is coextensive with the claimed invention. *Polaris Indus., Inc. v. Artic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018) (“[W]hen the thing that is commercially successful is not coextensive with the patented invention—for example, if the patented invention is only a component of a commercially successful machine or process—the patentee must show prima facie a legally sufficient relationship between that which is patented and that which is sold.”) (internal citation and quotation marks omitted). Neither 10X nor Staff provide analysis regarding whether the domestic industry products are coextensive with the claimed invention.

At least in some instances, the claimed invention is only a component of the domestic industry products. For example, the asserted claims of the ’204 patent are directed to droplets containing capsules, wherein the capsules contain barcode molecules. *See, e.g.*, ’204 patent, col. 44:42-49 (unasserted claim 1), col. 46:24-27 (claim 27). Although the domestic industry products have such capsules in the form of a gel beads, they also include unclaimed components, such as “microfluidic chips, chip holders, droplet generating instruments, . . . and various other reagents.” CIB at 5. Accordingly, I find that the domestic industry products’ practice of the asserted claims does not trigger the presumption of a nexus.

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Although the presumption of a nexus does not apply, 10X has shown that the evidence relating to the success of its products is sufficiently related to the claimed invention to provide the necessary nexus. All of the asserted claims require a droplet containing a capsule that is capable of releasing barcode molecules. *See, e.g.*, CX-1827C (Dear RWS) at Q/A 966. This claimed invention is employed in the domestic industry products in the form of “GemCode” or “GEM technology,” wherein gel beads capable of releasing barcode molecules are encapsulated in droplets. *Id.* at Q/A 966. Using GEM technology, the domestic industry products are able to achieve “high-throughput profiling of large numbers of single cells or molecules in a single procedure.” *Id.* As discussed below, the ability to achieve a high-throughput was the key to the domestic products’ success. Conversely, the failure of a competitor with a commanding position in the market to develop a high-throughput solution led to the competitor abandoning the market.

Bio-Rad counters that high throughput “is not a patented feature of the commercial product.” RIB at 219. The domestic industry products, however, are only able to achieve a high throughput by using the claimed invention, *viz.*, by encapsulating gel beads with attached barcode molecules into droplets. CX-1827C (Dear RWS) at Q/A 967. This relationship between the domestic industry product’s high throughput and the claimed invention provides the necessary nexus. *See Rambus Inc. v Rea*, 731 F.3d 1248, 1256-57 (Fed. Cir. 2013) (finding a nexus between evidence relating to the unclaimed high speed achieved by a memory system and the challenged claims, because the high speed was enabled by the claimed functionality).

ii. The success of the domestic industry products and the failure of a competitor to develop a competing product weigh against obviousness.

Bio-Rad does not dispute that the domestic industry products (1) solved a long-felt need, (2) received industry praise, (3) were a commercial success, and (4) that others failed in

developing a high-throughput system. With regard to long-felt need, at the time of the invention, it was widely recognized that it would be beneficial for both single-cell analysis and linked-read analysis to increase the single-run throughput of the single cells or molecules being analyzed.

For instance, in the context of single-cell analysis, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] *Id.*

At the time of the presentation, the industry leader in the field of sample preparation systems for SCG was Fluidigm. *Id.* at .00011; CX-0016C (Kaihara Dep. Tr.) at 25:19-26:3. In 2012, Fluidigm released its “C₁ Single-Cell AutoPrep System for cell isolation, sample prep, and analysis.” CX-1946C.00011 (bold-face type removed), *see also, id.* at .00003 (“2012: Introduction of Fluidigm’s SC automated cell prep instrument”). The Fluidigm system had throughput of “up to 96 cells per run.” *Id.* at .00013. This, however, was inadequate, as it was necessary to analyze “many more single cells . . . within a single experiment” in order “to address biological and stoichiometric noise or at least to achieve a better understanding of cell-to-cell variation within tissue[.]” CX-1269.00005 (quoting Jokim Lundeberg, KTH Royal Institute of Technology (Sweden)) (internal quotation marks omitted). This left an [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. In the

2014 timeframe, such a need was even acknowledged by Fluidigm’s CEO: “As the science of single-cell analysis unfolds, it’s clear to us the field is evolving in several important ways.

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[There is] an increasing need for higher throughput to enable large volume studies.” CX-1946C.00012 (quoting Fluidigm CEO, Gajus Worthington) (internal quotation marks omitted and alterations in original). In the context of linked-read technology, high throughput was also a “long-felt but unresolved need in accessing long range DNA sequence information.” CX-1827C (Dear RWS) at Q/A 997.

Upon its introduction, 10X’s GEM technology received industry praise and recognition. In particular, Dr. Hindson presented 10X’s GEM technology at the Advances in Genome Biology Technology conference (“AGBT”). CX-0001C (Hindson WS) at Q/A 143-48. After Dr. Hindson described the data that was obtained through the technology, the audience applauded. *Id.* at 149-50. Dr. Agresti, who attended the conference on behalf of Bio-Rad, congratulated Dr. Hindson on “10X’s achievements and said something to the effect that he’s real amazed and it’s awesome what we’ve done with the technology.” *Id.* at Q/A 152-53. As acknowledged by Dr. Tzonev, another Bio-Rad witness, 10X’s presentation at the AGBT [REDACTED] [REDACTED] CX-0023C (Tzonev Dep. Tr.) at 127:19-25.

The domestic industry products have been a commercial success. Between the second quarter of 2015 and the second quarter of 2018, the domestic industry products generated \$159 million in revenues. CX-1827C (Dear RWS) at Q/A 1073; JX-0043C. 10X has sold the domestic industry products to over 550 customers, including the National Institutes of Health, University of California, Harvard University, Cornell University, California Institute of Technology, Dartmouth College, Duke University, Georgetown University, John Hopkins University, and the University of Georgia. CX-1827C (Dear RWS) at Q/A 1071-72; CX-1265C.

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The success of 10X's domestic industry products stands in marked contrast to Fluidigm's failure to develop a competing high throughput product. Although it was "the sole player in the single cell market in 2009" and recognized by at least 2014 that there was "an increasing need for higher throughput to enable large volume studies," Fluidigm was ultimately unable to develop a high throughput solution. CX-1827C (Dear RWS) at Q/A 1078-1083; CX-1691C.00024; CX-1946C.00012 (quoting Fluidigm CEO, Gajus Worthington). In a May 4, 2017 earnings call, Fluidigm acknowledged that its "single-cell genomics business," which was "overwhelmingly [Fluidigm's] C1 product line, was down in the quarter by over 70% year-on-year." CX-1273.00003. One of the reasons for the decline, according to Fluidigm, was "the announcement of new competition." *Id.* As a result of the decline, Fluidigm announced that it would continue "to shift [its] primary business focus" away from the single cell market. *Id.*

In view of the foregoing, I find that the domestic industry products solved a long-felt, but unmet need, received industry praise, were commercially successful, and that another tried but failed to develop a solution to satisfy the unmet need. I further find that this evidence weighs against obviousness.

b. 10X has not established that Bio-Rad copied the claimed invention.

10X argues that Bio-Rad's copying of the claimed invention shows that the invention is not obvious. 10X's argument that Bio-Rad copied its invention, however, is unpersuasive. 10X publicly disclosed its GEM technology for the first time at the February 2015 AGBT conference, which was attended by Dr. Agresti and two other Bio-Rad employees. CX-0001C (Hindson WS) at Q/A 143; 151-53. [REDACTED]

[REDACTED]. Prior to joining Bio-Rad, Dr. Agresti worked at [REDACTED]

Amyris, where he [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. By at least 2009, as shown in a paper that he co-authored, Dr. Agresti was aware that a gel beads could be used to deliver DNA molecules to droplets. RX-0102.00001 (“[T]he gel particles can be functionalized with a variety of compounds, including fluorophores, DNA fragments, antibodies, and enzymes.”); RX-0503C (Agresti DWS) at Q/A 40. The paper notes that gel particles “are useful substrates for chemical and biological applications” and “[t]he compliance of the particles prevents clogging of the channels” of microfluidic devices. RX-0102.00001.

[illegible][illegible]

1. *Journal of the American Medical Association*, 271:1231-1232, 1994.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

The presentation attached to the end

[REDACTED]

[REDACTED]. JX-0067C.00014; RX-0503C (Agresti DWS) at Q/A 54.

Accordingly, there is clear documentary evidence, as well as Dr. Agresti's testimony, showing that, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

In support of its argument that Bio-Rad copied the claimed invention, 10X points to Dr. Agresti's trial testimony and an [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]—is an advantage discussed in the 2009 paper he co-authored, entitled “Beating Poisson encapsulation statistics using close-packed ordering.” RX-0102.0001. (“We use compliant gel particles in these experiments. The compliance of the particles prevents clogging of the channels.”) (footnotes omitted).

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. 10X’s argument is unpersuasive.

[REDACTED]

Based on the foregoing, I find that 10X has not shown that Bio-Rad copied the claimed invention.

V. THE '468 PATENT

A. Asserted Claims

10X is asserting claims 1, 6, 7, 9, and 21 of the '468 patent. Claim 1 is independent and the remaining claims depend directly or indirectly from claim 1. Claim 1 recites:

A method for droplet generation, comprising:

- (a) providing at least 1,000,000 oligonucleotide molecules comprising barcode sequences, wherein said barcode sequences are the same sequence for said at least 1,000,000 oligonucleotide molecules, wherein said at least 1,000,000 oligonucleotide molecules are releasably attached to a bead, wherein said bead is porous;
- (b) combining said at least 1,000,000 oligonucleotide molecules and a sample comprising a nucleic acid analyte each in an aqueous phase at a first junction of two or more channels of a microfluidic device to form an aqueous mixture comprising said at least 1,000,000 oligonucleotide molecules attached to said bead and said sample; and

- (c) generating a droplet comprising said at least 1,000,000 oligonucleotide molecules attached to said bead and said sample comprising said nucleic acid analyte by contacting said aqueous mixture with an immiscible continuous phase at a second junction of two or more channels of said microfluidic device.

'468 patent (JX-0005), col. 33:56-col. 34:9.

Claims 6, 7, 9, and 21 depend directly from claim 1. Claim 6 requires that the bead be formed from a polyacrylamide. *Id.*, col. 34:25-26. Claim 7 requires that the bead be a gel bead. *Id.*, col. 34:27. Claim 9 requires that the “at least 1,000,000 oligonucleotide molecules” have a region that functions as a primer. *Id.*, col. 34:30-32. Claim 21 requires that after the generation of a droplet “a given oligonucleotide molecule of said at least 1,000,000 oligonucleotide molecules attaches to said nucleic acid analyte,” before being “subjected to nucleic acid amplification to yield a barcoded nucleic acid analyte.” *Id.*, col. 35:3-9.

B. Claim Construction

The parties agreed to construe “barcode” to mean a “label that may be attached to an analyte to convey identifying information about the analyte.” Order No. 22 at 2. In the *Markman* order, “1,000,000 oligonucleotides comprising barcode sequences” was construed to mean “1,000,000 oligonucleotide molecules that include, but are not necessarily limited to, barcode sequences.” *Id.* at 17-22. The term “releasably attached” was construed to mean “attached in a manner that allows the attached object to be released.” *Id.* at 22-30. The term “amplification” was construed to mean “increasing the number of copies of the target sequence to be detected,” including by reverse transcription. *Id.* at 31-45.

C. Infringement

10X accuses Bio-Rad of infringing claims 1, 6, 7, 9, and 21 of the '468 patent.

1. Claim 1

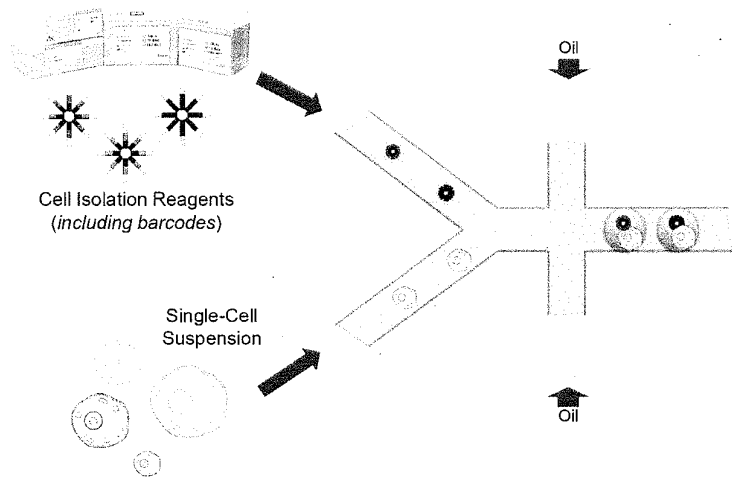
There is no dispute that Bio-Rad's ddSEQ system includes a method for droplet generation, and 10X relies on Dr. Butte's analysis to show infringement of the limitations of claim 1 of the '468 patent. CX-0004C at Q/A 418-437.

a. "providing at least 1,000,000 oligonucleotide molecules . . ."

There is no dispute with respect to a majority of the elements in the first limitation of claim 1 of the '468 patent, which includes limitations that are substantively identical to those discussed above for claim 1 of the '024 patent. Dr. Butte refers back to his analysis for the '024 patent for these limitations, which require "providing at least 1,000,000 oligonucleotide molecules," that the "barcode sequences are the same," that the molecules are "releasably attached to a bead," and "said bead is porous." CX-0004C at Q/A 422-424. As discussed above, Bio-Rad disputes infringement of the "releasably attached" limitation, but its non-infringement arguments are not consistent with the claim construction adopted in this investigation. Accordingly, the accused ddSEQ products infringe the "providing . . ." limitation of claim 1 of the '468 patent.

b. "combining said at least 1,000,000 oligonucleotide molecules and a sample comprising a nucleic acid analyte each in an aqueous phase . . ."

Dr. Butte identifies Bio-Rad documentation describing the mixing of two input aqueous solutions in the ddSEQ v1 process: one solution contains the oligonucleotide molecules and the other solution contains a sample of single cells comprising the mRNA nucleic acid analyte. CX-0004C at Q/A 427-28. Dr. Butte testifies that these two solutions are combined at a first junction of two channels of the ddSEQ v1 cartridge, citing a Bio-Rad document showing the mixing of the aqueous solutions. *Id.* at Q/A 429.



JX-0035.00009. He further cites the testimony of Bio-Rad employee Lucas Frenz, describing the junction where the two solutions are combined. CX-0011C (Frenz Dep. Tr.) at 229-30.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Bio-Rad contends that Dr. Butte's testimony fails to carry 10X's burden to show infringement of this limitation. RIB at 165-66.¹² In particular, Bio-Rad cites Dr. Butte's testimony on cross-examination where he agrees that [REDACTED]

[REDACTED] Tr.

408:6-13. Dr. Butte further testifies that "it would be a big mess" if the two solutions mixed "without forming a droplet." *Id.* at 409:12-21. As Dr. Butte further explains his testimony,

¹² Pursuant to Order No. 39 (Mar. 12, 2019), Bio-Rad was precluded from offering affirmative evidence of non-infringement regarding this limitation.

however, these statements do not contradict his infringement opinions. *See* SRB at 43-44.

Dr. Butte explains that the two solutions [REDACTED]

[REDACTED] *Id.* And although he concedes that “lysis might start, it takes time to complete.” *Id.* at 408:20-498:2. When Dr. Butte’s cross-examination testimony is considered in the context of his infringement opinions and the evidence from Bio-Rad’s documents and testimony, there is a preponderance of evidence that the ddSEQ system infringes the “combining” limitation.

c. “generating a droplet . . .”

There is no dispute with respect to the elements of the final limitation of claim 1.

Dr. Butte identifies evidence that a droplet is formed when the mRNA or genomic DNA fragment contacts the aqueous mixture at a second junction. CX-0004C at Q/A 436-37. This droplet generation is depicted in Bio-Rad documents.



JX-0088C.00013. Dr. Butte explains how the limitation is met for both the ddSEQ v1 [REDACTED] products. CX-0004C at Q/A 436-37. Dr. Frenz confirmed the location of the junction in the ddSEQ v1 [REDACTED] cartridges. CX-0011C at 231-32; CX-0056C; CX-1458C.

Accordingly, both the ddSEQ v1 [REDACTED] processes infringe the method of claim 1 of the '468 patent.

2. Dependent Claims

There is no dispute with respect to the ddSEQ system's infringement of the limitations in dependent claims 6, 7, 9, and 21 of the '468 patent. CIB at 197-98; SIB at 92.

As discussed in the context of the '024 patent, there is no dispute that the ddSEQ system uses a gel bead comprised of [REDACTED], as required by claims 6 and 7 of the '468 patent. See CX-0004C (Butte DWS) at Q/A 224-26, 438-43.

Claim 9 of the '468 patent requires that the oligonucleotide molecule "comprises a region which functions as a primer." Dr. Butte explains that in the WTA 3' v1 [REDACTED] [REDACTED]. CX-0004C at Q/A 446. In the scATAC-seq [REDACTED] assays, the Nextera Adaptor binding sequence attaches to the Nextera Adaptor and functions as a primer during PCR in the droplet. *Id.*

Claim 21 of the '468 patent requires that the "nucleic acid analyte is subjected to nucleic acid amplification to yield a barcoded nucleic acid analyte." The limitations of this claim are similar to those recited in limitation (c) of claim 1 of the '024 patent, and the ddSEQ system infringes claim 21 for the same reasons discussed above. See CX-0004C (Butte DWS) at Q/A 449.

Accordingly, [REDACTED] the ddSEQ v1 [REDACTED] processes infringe claims 6, 7, 9, and 21 of the '468 patent.

3. Indirect Infringement

10X accuses Bio-Rad of indirect infringement of the method claims of the '468 patent based on the same evidence cited for the '024 patent. CIB at 198. Staff and Bio-Rad raise the same indirect infringement arguments for the '468 patent that were addressed in the context of the '024 patent. RIB at 166; SIB at 92-93.

As discussed above, 10X has shown that the ddSEQ v1 system has been used in the United States, [REDACTED]. For the same reasons discussed above in the context of the '024 patent, 10X has thus shown that Bio-Rad has induced infringement and contributorily infringed claims 1, 6, 7, 9, and 21 of the '468 patent by importing and selling components of the ddSEQ v1 system.

D. Domestic Industry

10X contends that its DI products practice claims 1, 6, 7, 9, and 21 of the '468 patent, relying on the testimony of Dr. Butte. CIB at 198-201; CX-0004C at Q/A 450-77.

1. Claim 1

There is no dispute that the DI products include a method for droplet generation, and 10X relies on Dr. Butte's analysis to show infringement of the limitations of claim 1 of the '468 patent. CX-0004C at Q/A 453-66.

There is no dispute with respect to the first limitation of claim 1 of the '468 patent, which includes limitations that are substantively identical to those discussed above for claim 1 of the '024 patent. Dr. Butte refers back to his analysis for the '024 patent for these limitations, which require "providing at least 1,000,000 oligonucleotide molecules," that the "barcode sequences are the same," that the molecules are "releasably attached to a bead," and "said bead is porous." CX-0004C at Q/A 455-56.

With respect to the second limitation of claim 1 of the '468 patent requiring forming an aqueous mixture, Dr. Butte identifies two aqueous input solutions for 10X's single-cell products: one solution comprising an mRNA nucleic acid analyte and a second solution including gel beads with oligonucleotide molecules attached. CX-0004C at Q/A 458-59. He further identifies a junction of channels on the Chromium Single Cell 3' microfluidic chip where the two solutions

are combined. *Id.* at Q/A 460. With respect to 10X's linked-read products, Dr. Butte identifies a Sample Master Mix with denatured genomic DNAs and a second solution containing gel beads. *Id.* at Q/A 462. He further identifies the junction on the Chromium Genome microfluidic chip where the two solutions are combined. *Id.* at Q/A 463. Bio-Rad argues that 10X has failed to carry its burden with respect to the "aqueous solution" limitation, raising arguments similar to those discussed above in the context of infringement. RIB at 166-67. As discussed above, however, Dr. Butte's testimony on cross-examination does not contradict his affirmative opinions with respect to this limitation.

There is no dispute with respect to the third limitation of claim 1 of the '468 patent, which requires generating a droplet. Dr. Butte identifies images of the claimed second junction in the 10X single-cell and linked-read applications and documents showing the portioning oil loaded on the Genome microfluidic chip. CX-0004C at Q/A 465-66; CX-0581C; CX-0622C; CX-0481; CX-0578.

Accordingly, the DI products practice claim 1 of the '468 patent.

2. Dependent Claims

There are no disputes with respect to the limitations recited in dependent claims 6, 7, 9, 10, 17, and 21 of the '468 patent. CIB at 200-01; SIB at 94.

With respect to claims 6 and 7, Dr. Butte refers back to his opinions with respect to the '024 patent, and there is no dispute that the DI products use a polyacrylamide gel bead. CX-0004C at Q/A 467-70.

With respect to claims 9 and 10, Dr. Butte explains that the DI products use the 10X Barcoded Primer—in the single-cell applications, the poly-T sequence attaches to the mRNA and functions as a primer during reverse transcription, and in the linked-read applications, a 6

nucleotide random primer is used in isothermal amplification. CX-0004C at Q/A 472; CX-0579; CX-0578.

With respect to claim 17, Dr. Butte explains that the gel bead is dissolved upon application of [REDACTED]. CX-0004C at Q/A 476.

With respect to claim 21, Dr. Butte refers to his testimony regarding the '024 patent, explaining how the DI products undergo amplification. CX-0004C at Q/A 478.

Accordingly, the DI products practice claims 1, 6, 7, 9, 10, 17, and 21 of the '468 patent.

E. Invalidity

Bio-Rad contends that the asserted claims of the '468 patent are invalid as anticipated or rendered obvious by the '059 patent (JX-0031), alone or in combination with additional prior art, including Hinz (RX-0461), PCT Pub. No. WO 2010/036352 A1 naming inventors Billy W. Colston, Jr. and Benjamin J. Hindson, *et al.* (RX-0473, "Colston"), and U.S. Patent App. Pub. No. US 2012/0220494 A1 naming inventor Michael Samuels *et al.* (RX-0474, "Samuels"). RIB at 168-85.

1. "at least 1,000,000 oligonucleotide molecules . . . releasably attached to a bead"

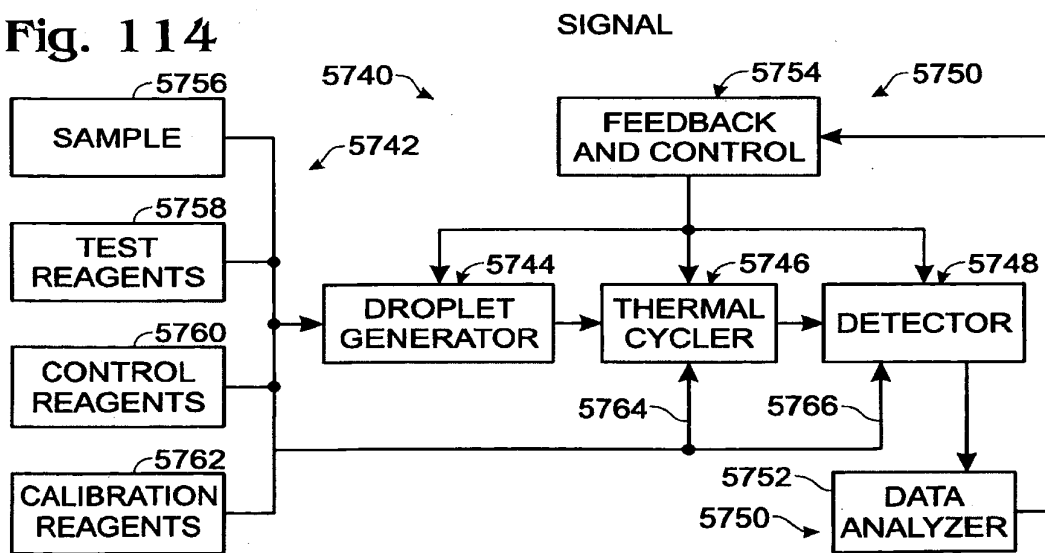
As discussed above in the context of the '024 patent, Bio-Rad has failed to show that the '059 patent anticipates or renders obvious, alone or in combination with other references, the claim limitation requiring that oligonucleotide molecules be releasably attached to a bead. For this reason alone, Bio-Rad has not shown that the asserted claims of the '468 patent are invalid.

2. "combining said at least 1,000,000 oligonucleotide molecules and a sample comprising a nucleic acid analyte each in an aqueous phase at a first junction"

Bio-Rad contends that the "combining" step of claim 1 of the '468 patent is anticipated or rendered obvious by the '059 patent through the incorporation by reference of Colston. RIB at

170-79. In the '059 patent's discussion of droplet generation, the specification states that droplets may be generated by devices described in Colston. JX-0031, col. 13:8-14. Colston is a patent application published in April 2010 that is assigned to QuantaLife, naming Dr. Hindson as one of the co-inventors. RX-0473. Colston teaches that "samples and/or reagents may be . . . mixed selectably before they are supplied to a downstream region of the system," identifying a "droplet generator" as one such region. *Id.* at 243. Figure 114 of Colston is a schematic showing the mixing of a sample and reagents prior to a droplet generator.

Fig. 114



RX-0473.000340, Fig. 114. Based on these disclosures, Dr. Metzker submits that the '059 patent discloses the combination of a nucleic acid analyte sample and oligonucleotide molecules at a first junction to form an aqueous mixture. RX-0664C at Q/A 264.

10X contends that Bio-Rad's anticipation argument fails because the '059 patent only references Colston in the context of droplet generation, with no discussion of mixing polynucleotides and barcode adaptors. CIB at 201-02. Dr. Dear notes that the '059 patent describes the step of combining adaptors with polynucleotides as "merging," rather than droplet

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formation. CX-1827C at Q/A 401 (citing JX-0031, col. 1:40-51). On this record, I agree with 10X that the “combining” limitation is not anticipated the ’059 patent’s incorporation of Colston by reference.

Bio-Rad further contends that it would have been obvious to combine the ’059 patent’s polynucleotides and barcode adaptors with the microfluidics disclosed in Colston. RIB at 170-72. Dr. Metzker suggests that one of ordinary skill “would have been motivated . . . to keep assay reagents separate from the nucleic acid or cellular analyte solutions” and “would have been motivated to see what methods others have used in droplet formation devices to improve the efficiency of her system.” RX-0664C at Q/A 265. 10X disagrees with these obviousness contentions, arguing that Colston’s disclosures are too vague to render obvious the “first junction” limitation of the ’468 patent. CIB at 201-02. As explained by Dr. Dear, Colston does “not disclose how reagents and samples are combined, beads with barcodes, a junction of two channels to form an aqueous mixture of beads with barcodes and sample, and generation of droplets with beads and sample at a second junction.” CX-1827C at Q/A 403. Dr. Dear further criticizes Dr. Metzker’s reliance on Figure 114, because it is a “schematic” rather than a “microfluidic layout.” *Id.* at Q/A 404. In reply, Bio-Rad argues that the ’468 patent itself has no figures illustrating the claimed junctions and cites cross-examination testimony from Dr. Dear admitting that Colston shows mixing of the sample and reagents in an aqueous phase. RRB at 85; Tr. (Dear) at 902.

Although I agree with Bio-Rad that the disclosures in Colston are sufficient to show the mixing of a sample and reagents in an aqueous phase, Bio-Rad has failed to offer clear and convincing evidence that it would have been obvious to apply this mixing to the polynucleotides and barcode adaptors in the ’059 patent. Dr. Metzker only offers conclusory opinions regarding

the motivations of one of ordinary skill in the art to implement a microfluidics system meeting the limitations of the '468 patent. RX-0664C at Q/A 265. Bio-Rad fails to cite any evidence from the '059 patent or other contemporaneous references indicating a need or desire to implement a particular microfluidic mixing process for the '059 patent's polynucleotides and barcode adaptors. Accordingly, Bio-Rad has failed to carry its burden to show that this limitation is obvious in view of the '059 patent, alone or in combination with Colston.

Bio-Rad's proposed combinations of the '059 patent with other references fail for the same reason, because Dr. Metzker only offers conclusory opinions regarding the obviousness of combining these references. *See* RX-0664C at Q/A 268. Although Samuels (RX-0474), Song (RX-0475), and Abate (RX-0102) teach microfluidic systems that meet at least some of the claim limitations of the '468 patent, Bio-Rad fails to identify a credible reason for implementing these processes to mix the polynucleotides and barcode adaptors of the '059 patent. There is no evidence that these references solve a known problem for the process described in the '059 patent, and there is no evidence that the particular microfluidic systems identified by Bio-Rad are among a finite number of identified, predictable solutions. Accordingly, Accordingly, Bio-Rad has failed to carry its burden on obviousness with respect to this limitation.

3. “generating a droplet . . . by contacting said aqueous mixture with an immiscible continuous phase at a second junction”

Bio-Rad contends that the “generating a droplet” step of claim 1 of the '468 patent is anticipated or rendered obvious by the '059 patent alone or in combination with Colston and Samuels. RIB at 179-83. In particular, Bio-Rad cites a disclosure in the '059 patent that “[m]icrofluidic methods of producing emulsion droplets using microchannel cross-flow focusing on physical agitation can produce either monodisperse or polydisperse emulsions.” JX-0031, col. 14:6-8. Dr. Metzker submits that “[o]ne of ordinary skill in the art would have understood

that the ‘cross-flow focusing’ as taught by Saxonov involves the concept of flow-focusing using a cross junction with two or more input channels, one being oil and one being an aqueous channel.” RX-0664C at Q/A 276.

The ’059 patent’s reference to “cross-flow focusing” is not sufficient to anticipate the “generating a droplet” limitation of the ’468 patent. As Dr. Dear explains, the ’059 patent’s discussion of droplet generation is separate from any discussion of mixing polynucleotides and barcode adaptors. CX-1827C at Q/A 427. Accordingly, Bio-Rad’s anticipation argument fails for the same reasons discussed above for the “combining” limitation.

Bio-Rad’s obviousness arguments for the “generating a droplet” limitation rely on the same combinations discussed above for the “combining” limitation. RIB at 180-83. Again, Bio-Rad fails to offer credible evidence for using the microfluidic systems disclosed in Colston, Samuels, Song, or Abate with the polynucleotides and barcode adaptors of the ’059 patent. Accordingly, Bio-Rad’s obviousness arguments fail to the same reasons discussed above for the “combining” limitation.

4. Secondary considerations of non-obviousness

For the same reasons discussed above in the context of the ’024 patent, the success of 10X’s domestic industry products further weigh against a finding of obviousness.

VI. THE ’204 PATENT

A. Asserted Claims

10X is asserting claims 27, 29, 31, and 33 of the ’204 patent. The asserted claims depend from unasserted independent claims 1, 23, and 25. Unasserted claim 1 recites:

A composition comprising a plurality of capsules, said capsules situated within droplets in an emulsion, wherein said capsules are configured to release their contents into said droplets upon the application of a stimulus to provide said contents in said droplets in said emulsion,

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wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof.

Id., col. 44:42-48. Asserted claims 27 and 33 depend directly from claim 1. Claim 27 requires that the contents of each capsule “comprise at least 10,000 barcoded oligonucleotides releasably attached” to the capsule. *Id.*, col. 46:24-26. Claim 33 limits the claimed capsules to gel capsules. *Id.*, col. 46:42-43.

Unasserted claim 23 recites:

A device comprising a plurality of partitions, wherein at least one partition of said plurality of partitions comprises a capsule, wherein said capsule is situated within a droplet in an emulsion, wherein said capsule is configured to release its contents into said droplet upon the application of a stimulus to provide said contents in said droplet in said emulsion, wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof.

Id., col. 45:51-58. Claim 29 depends directly from claim 23 and requires that the contents of the claimed capsule “comprise at least 10,000 barcoded oligonucleotides releasably attached” to the capsule. *Id.*, col. 46:30-32.

Unasserted claim 25 recites:

A method comprising:

- a. providing a plurality of inner capsules, said inner capsules situated within outer capsules in an emulsion, wherein said inner capsules are configured to release their contents into said outer capsules upon the application of a stimulus, wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof; and
- b. providing a stimulus to cause said inner capsules to release their contents into said outer capsules in said emulsion.

Id., col. 46:3-12. Claim 27 requires that the contents of each capsule “comprise at least 10,000 barcoded oligonucleotides releasably attached” to the capsule. *Id.*, col. 46:36-38.

For the technical prong of the domestic industry requirement, in addition to the asserted claims, 10X relies on claim 10 of the '204 patent. Claim 10 depends from claim 1 through claims 2, 7, and 8. Claim 1 is recited above. Claim 2 requires that the capsules of claim 1 include “at least one of said capsules and said droplets comprise a species selected from the group consisting of a reagent and an analyte.” *Id.*, col. 44:50-52. Claim 7 requires that the analyte of claim 2 be selected “from the group consisting of a cell, a polynucleotide, a chromosome, a protein, a peptide, a polysaccharide, a sugar, a lipid, a small molecule, and combinations thereof.” *Id.*, col. 44:66-col. 45:2. Claim 8 requires the analyte of claim 7 to be a polynucleotide. *Id.*, col. 45:3-4. Claim 10 requires that the amount of polynucleotide in the composition of claim 8 be “sufficient to provide about 100-200X sequence coverage.” *Id.*, col. 45:8-10.

B. Claim Construction

The parties agreed to construe “barcode” to mean a “label that may be attached to an analyte to convey identifying information about the analyte.” Order No. 22 at 2. They agreed to construe “wherein said capsules are [capsule is] configured to release their [its] contents into said droplets [droplet] upon the application of a stimulus” to have its plain and ordinary meaning. *Id.*

C. Infringement

10X asserts that Bio-Rad’s ddSEQ v1 [REDACTED] products infringe claims 27, 29, 31, and 33 of the '204 patent. With the exception of claim 33, the asserted claims of the '204 patent require a “capsule” or “capsules,” wherein the contents of each capsule include barcode molecules that are “releasably attached” to the capsule. '204 patent, col. 44:42-49 (claim 1), col.

46:24-26 (claim 27), col. 46:30-32 (claim 29), col. 46:36-38 (claim 31). Bio-Rad's infringement argument relating to the "releasably attached" limitation are addressed above in the context of the '024 and '468 patents and are rejected for the same reasons in the context of the '204 patent. All of the asserted claims require a "capsule" or "capsules" that are "configured to release their contents into said droplets upon the application of a stimulus." *Id.*, col. 44:44-46 (claim 1), col. 46:5-7 (claim 25); *see also id.*, col. 45:53-56 (claim 23) ("wherein said capsule is configured to release its contents into said droplet upon the application of a stimulus to provide said contents in said droplet in said emulsion"). The parties agreed that the term "wherein said capsules are [capsule is] configured to release their [its] contents into said droplets [droplet] upon the application of a stimulus" did not need to be construed and should be given its "plain and ordinary meaning." Order No. 22 (Oct. 31, 2018) at 2. The claims further require that the stimulus be "selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof." *Id.*, col. 44:46-49 (claim 1), col. 45:56-58 (claim 23), col. 46:7-10 (claim 25).

For the reasons set forth below, the accused products do not literally infringe the asserted claims because they do not have a stimulus "selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof." In addition, 10X is estopped from relying on the doctrine of equivalents to show infringement.

1. Literal Infringement

The claims require that the capsules release their contents in response to a stimulus that is "selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof." '204 patent, col. 44:44-46 (claim 1), col. 45:44-58 (claim 23), col. 46:5-10 (claim 25). The recited stimuli form a "Markush group." In Markush

claims, alternative species or elements that can be selected as part of the claimed invention are listed as a group, called a Markush group. *Multilayer Stretch Cling Film Holdings, Inc. v Berry Plastics Corp.*, 831 F.3d 1350, 1357 (Fed. Cir. 2016) (citing *Abbott Labs. v. Baxter Pharm. Prods., Inc.*, 334 F.3d 1274, 1280 (Fed. Cir. 2003)). The term “group of” is traditionally used by patent drafters to signal a Markush group. *Id.* (citing *Gillette Co. v. Energizer Holdings, Inc.*, 405 F.3d 1367, 1372 (Fed. Cir. 2005)). Typically, Markush groups take the following form: “a member selected from the group consisting of A, B, and C.” *Id.* (quoting *Gillette*, 405 F.3d at 1372) (internal quotation marks omitted). Each member of a Markush group is “alternatively usable for the purposes of the invention.” *Id.* at 1357-58 (quoting *In re Driscoll*, 562 F.2d 1245, 1249 (CCPA 1977)) (internal quotation marks omitted).

In the accused products, 10X argues that the barcode molecules are linked to the gel bead by “chemical bonds susceptible to [REDACTED] so that the barcode molecules are released when the [REDACTED]. CIB at 173. It is undisputed that the [REDACTED] are not one of the recited stimuli. *See, e.g.*, Tr. (Butte) at 371:24-372:17 (testifying that [REDACTED] by themselves are not a change in pH or ion concentration and do not reduce disulfide bonds). 10X, however, points to evidence showing that [REDACTED] [REDACTED] *See, e.g.*, CX-0004C (Butte DWS) at Q/A 317-319. Relying on this evidence, 10X identifies the combination of the [REDACTED] as the claimed stimulus. CIB at 173. While Bio-Rad and Staff dispute 10X’s contention that the presence of [REDACTED] [REDACTED] the accused products still would not literally infringe the asserted claims.

While there is no dispute that the addition of [REDACTED] constitutes a “change in the ion concentration,” which is a recited element of the Markush group, there is no evidence that the [REDACTED] would have any effect on the attached barcode molecules or the gel bead. *See, e.g.*, Tr. (Butte) at 474:18-21 (“Q: And you did not provide an opinion in your witness statement that [REDACTED] A: That’s correct.”). Rather, according to 10X’s expert, Dr. Butte, [REDACTED] [REDACTED] sever the barcode molecules from the gel bead. *See, e.g.*, CX-0004C (Butte DWS) at Q/A 318. Thus, as understood by Dr. Butte, the stimulus that causes the release of the barcode molecules from the gel bead in the accused products is the [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Dr. Butte’s identification of the [REDACTED] in combination with a change in magnesium ion concentration for the claimed stimulus is legally flawed. By its express language—“wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof”—the Markush group at issue is limited to (1) one of the recited stimuli or (2) a combination of the recited stimuli; it does not encompass a combination of a recited stimulus and an unrecited

stimulus. In particular, the asserted claims define the Markush group as “consisting of” the recited stimuli and combinations thereof, as opposed to being “comprised” of the recited stimuli. “‘Consisting of’ is a term of patent convention meaning that the claimed invention contains only what is expressly set forth in the claim.” *Multilayer*, 831 F.3d at 1358 (quoting *Norian Corp. v. Stryker Corp.*, 363 F.3d 1321, 1331 (Fed. Cir. 2004)) (internal quotation marks omitted). While the term “comprising” would have indicated that the group was open to additional, unrecited stimuli, the term “consisting of” indicates that unrecited stimuli are excluded from the group. *Id.* at 1358.

As explained by the Federal Circuit, “[t]he presumption that a claim term set off by the transitional phrase ‘consisting of’ is closed to unrecited elements is at least a century old and has been reaffirmed many times by our court and other courts.” *Id.* While “the exceptionally strong presumption that a claim term set off with ‘consisting of’ is closed to unrecited elements” may be overcome if a patentee acts as his own lexicographer and “give[s] ‘consisting of’ an alternative, less restrictive meaning,” the specification and prosecution history must “unmistakably manifest [such] an alternative meaning.” *Id.* 10X does not contend that the patentees acted as their own lexicographers and re-defined “consisting of.”

As shown in *Multilayer*, the closed nature of the claim language at issue excludes a combination of a recited stimulus (change in ion concentration) and an unrecited stimulus (enzymes). In *Multilayer*, the asserted claims were directed to a thermoplastic stretch wrap film having two outer layers and five inner layers. *Id.* at 1353. The claims further required that “five identifiable inner layers” be formed from materials selected from a Markush group “consisting of” various resins. *Id.* At issue was whether an inner layer composed of a combination of a recited resin and an unrecited resin fell outside the scope of the claimed Markush group. *Id.* at

1358. Answering the question in the affirmative, the Federal Circuit held that “constru[ing] the claims to cover any plastic film with five compositionally different inner layers, each of which contains any amount of one of the four recited resins,” would “render the ’055 patent’s Markush language—each layer being selected from the group consisting of—equivalent to the phrase ‘each layer comprising one or more of.’” *Id.* at 1358.

10X has not pointed to any basis for distinguishing the closed Markush group at issue in *Multilayer* that would allow interpreting the Markush group at issue in this investigation to encompass a combination of a recited stimulus and an unrecited stimulus. 10X’s only response to the argument that such a combination falls outside the scope of the claims, is to argue that the accused stimulus does not include the [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Relying on the [REDACTED] as the claimed stimulus has no legal basis and makes no logical sense. The claims require that the capsules release their contents in response to the claimed stimulus. *See* CIB at 181 (“The claimed function of applying a stimulus is to allow the release of the contents of a capsule into the droplet.”). 10X does not argue and there is no evidence that [REDACTED]

[REDACTED] will cause the release of barcode molecules from the gel beads. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

10X's attempt to limit the accused stimulus to the [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Based on the foregoing, I find that the accused products do not literally infringe the asserted claims.

2. Doctrine of Equivalents

10X argues that the accused products satisfy the stimulus under the doctrine of equivalents ("DOE"). CIB at 181-84. In the accused products, the barcode molecules are released from the gel bead when the [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. 10X, however, is precluded from relying on the DOE to satisfy the Markush group limitation.

Under the DOE, "a product or process that does not literally infringe upon the express terms of a patent claim may nonetheless be found to infringe if there is 'equivalence' between the elements of the accused product or process and the claimed elements of the patented invention." *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 21 (1997).

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Although the DOE allows a “patentee to claim those insubstantial alterations that were not captured in drafting the original patent claim but which could be created through trivial changes,” under prosecution history estoppel a patentee cannot use the DOE to recapture subject matter surrendered during prosecution. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 733-34 (2002) (“*Festo VIII*”). Such surrender occurs “[w]here the original application once embraced the purported equivalent but the patentee narrowed his claims to obtain the patent or to protect its validity.” *Id.*

Making a narrowing amendment to secure a claim’s issuance creates a presumption that prosecution history estoppel applies. *Id.* at 740-41. The presumption, however, is rebuttable as there may be some instances “where the amendment cannot reasonably be viewed as surrendering a particular equivalent.” *Id.* Such situations include where the equivalent was unforeseeable at the time of the application or where the rationale underlying the amendment bears no more than a tangential relation to the equivalent in question. *Id.* at 741.

During the prosecution of the ’204 patent, application claims 1, 78, and 110 matured into issued claims 1, 23, and 25, respectively. JX-0009.13630. In their original form, application claims 1 and 78 required a capsule (application claim 1) or capsules (application claim 78) “configured to release their contents . . . upon the application of a stimulus,” but did not require that the stimulus be selected from a particular group of stimuli. *Id.* at .00080 (application claim 1); *see also id.* at .00085 (application claim 78) (requiring a capsule “configured to release its contents into said droplets upon the application of a stimulus”). Similarly, application claim 110 required a step of “providing a stimulus to cause said capsules to release their contents into said droplets,” without requiring the stimulus be selected from a group of stimuli. *Id.* at .00087.

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Although application claim 1 did not limit the stimulus to a group of stimuli, two of its dependent claims did. Application claims 19 and 21 depended directly from application claim 1. Application claim 19 required the stimulus to be “selected from the group consisting of a chemical stimulus, a bulk stimulus, a biological stimulus, a light stimulus, a thermal stimulus, a magnetic stimulus, and combinations thereof.” *Id.* at .00081. Application claim 21 required the stimulus to be “selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof.” *Id.* at .00081.

In an office action issued on January 29, 2016, the examiner rejected all of the pending claims as being anticipated in view of several prior art references. *Id.* at .09770-09781. Application claim 1 was found to be anticipated by seven references: (1) U.S. Patent Publication No. 2005/007951 to Berka *et al.* (“Berka”), (2) U.S. Patent Publication No. 2015/0079510 to Church *et al.* (“Church”), (3) U.S. Patent Publication No. 2014.0227706 to Kato *et al.* (“Kato”), (4) U.S. Patent Publication No. 2003/0207260 to Trnovsky *et al.* (“Trnovsky”), (5) U.S. Patent Publication No. 2013/0189700 to So *et al.* (“So”); (6) U.S. Patent Publication No. 2004/0258701 to Dominowski *et al.* (“Dominowski”); and (7) U.S. Patent Publication No. 2009/0025277 to Takanashi (“Takanashi”) *Id.* at .09777-.099780. *Id.* at .09774-.099780. Application claim 19 was rejected as anticipated by five references: (1) Berka, (2) Trnovsky, (3) So, (4) Dominowski, and (5) Takanashi. *Id.* Application claims 78 and 110 were rejected as being anticipated by Berka. *Id.* Application claim 21 was rejected as being anticipated by Kato. *Id.*

On April 28, 2016, the applicants responded to the rejections by, *inter alia*, cancelling application claims 19 and 21 and amending application claims 1, 78, and 110. As amended, application claims 1, 78, and 110 incorporated application claim 21’s limitation requiring that the stimulus be “selected from the group consisting of a change in pH, a change in ion concentration,

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reduction of disulfide bonds, and combinations thereof.” *Id.* at .10009 (“[C]laims 1, 31, 78, 89, 110 and 118 have been amended to recite ‘wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof,’ thus incorporating the elements of Claim 21.”); *see also id.* at .10000, .10002, .10003. With this amendment, the applicants argued that the amended application claims were allowable over the cited prior art with the exception of Kato. *Id.* at .10009 (“Initially, as Claim 21 was rejected only over Kato, Applicant understands that the Office acknowledges that none of Berka, Church, Trnovsky, So, Dominowski and Takanashi teach or disclose ‘wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof,’ as recited in claims 1, 31, 78, 89, 110 and 118.”). With regard to Kato, the applicants argued that “Kato does not teach or disclose, ‘wherein said capsules are configured to release their contents into said droplets upon the application of a stimulus,’ as recited in Claim 1.” *Id.* at .10010. The applicants also argued that Kato did not qualify as prior art. *Id.*

On August 5, 2016, the examiner rejected the amended claims in view of a new set of prior art references and noted that the previous rejections had been rendered moot in view of the new grounds of rejection. *Id.* at .10074. The examiner also “noted that the 102(b) rejection of Claims 1 and 21 over Kato has been withdrawn in light of the applicant’s persuasive arguments.” *Id.* In response to the new rejections, the applicants further amended application claims 1, 78, and 110 to require that the capsule or capsules “provide said contents in said droplets in said emulsion” upon the application of a stimulus. *Id.* at .10118, .10120-.10121. The application claims as amended were allowed. *Id.* at .13617.

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10X argues that “[i]nfringement under the doctrine of equivalents is not barred here by the prosecution history estoppel because there was no disclaimer during prosecution of all chemical, bulk, or biological stimuli.” CIB at 182. 10X’s argument, however, is unpersuasive. A narrowing amendment made in order to gain issuance triggers the presumption that a patentee is estopped from relying on the DOE to show infringement. *Festo VIII*, 535 U.S. at 740-41. It is indisputable that the April 28, 2016 amendments to application claims 1, 78, and 110 narrowed the scope of the claims. As originally drafted, the application claims did not require the claimed stimulus to be selected from any group of stimuli, much less from the “group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof.” It is also indisputable that the narrowing amendment was made to overcome prior art as the applicants expressly cited the amendment to overcome several prior art references relied upon by the examiner: “[A]s Claim 21 was rejected only over Kato, Applicant understands that the Office acknowledges that none of Berka, Church, Trnovsky, So, Dominowski and Takanashi teach or disclose ‘wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof,’ as recited in claims 1, 31, 78, 89, 110 and 118.” JX-0009 at .10009

Thus, the applicants’ narrowing amendment triggers the presumption that 10X is estopped from relying on the DOE to show that accused products satisfy the stimulus limitation. *See Festo VIII*, 535 U.S. at 740-41. 10X attempts to rebut the presumption by arguing that the narrowing amendment was tangential to the alleged equivalent, which 10X identifies as [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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different Markush element, [REDACTED] The only basis that 10X has put forth in support of its contention that the amendment was tangential to the alleged equivalent is that the alleged equivalent was not disclosed in the prior art references relied upon by the examiner to reject the pending claims. This argument, however, fails on examination.

“[A]n amendment made to avoid prior art that contains the equivalent in question is not tangential; it is central to allowance of the claim.” *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabuskiki Co., Ltd.*, 344 F.3d 1359, 1369-70 (Fed. Cir. 2003) (“*Festo IX*”).¹⁴ It is 10X’s burden to show that the reason for the amendment is tangential to the alleged equivalent. *Id.* at 1369. Moreover, the reason for the amendment must be “objectively apparent” from the prosecution history “without the introduction of additional evidence, except, when necessary, testimony from those skilled in the art as to the interpretation of that record.” *Id.*; see also *Integrated Tech. Corp. v. Rudolph Techs., Inc.*, 734 F.3d 1352, 1358. This is a burden that 10X has not met.

At the hearing, 10X’s own expert Dr. Butte confirmed that one of the references in question, Trnovsky, discloses the use of the enzyme agarase as a stimulus. Tr. 431:14-16. Describing Trnovsky as a “complicated paper,” Dr. Butte further testified that he was unable to “tell one way or the other whether” Trnovsky disclosed the use of ion cofactors with agarase. *Id.* at 431:17-25. Dr. Butte, however, acknowledged that Trnovsky discloses “buffers used with

¹³ In its initial post-hearing brief, 10X also argued in the alternative that [REDACTED]. In its reply brief, however, 10X appears to have abandoned this argument. See CRB at 84-85.

¹⁴ The converse is not necessarily true. *Integrated Tech. Corp. v. Rudolph Techs. Inc.*, 734 F.3d 1352, 1358 (Fed. Cir. 2013) (“It does not follow . . . that equivalents not within the prior art must be tangential to the amendment.”) (quoting *Chimie v. PPG Indus. Inc.*, 402 F.3d 1371, 1383 (Fed. Cir. 2005)) (internal quotation marks omitted).

agarase which may provide a cofactor and that there may be an ion cofactor.” *Id.* at 432:1-5.

This testimony by its own expert is fatal to 10X’s argument that the reason for the narrowing amendment is tangential to the alleged equivalent.

10X’s only response to its expert’s testimony is to characterize it as “hypothetical testimony” and argue that surrender of the alleged equivalent must be shown through “the actual prior art disclosure and amendment in prosecution.” CRB at 85 n. 36.¹⁵ It is 10X’s burden, however, to show that the narrowing amendment is tangential to the alleged equivalent, not Staff’s and Bio-Rad’s burden to show the converse. *Festo IX*, 344 F.3d at 1369-70. 10X would be unable to meet its burden, even if its expert’s testimony on the issue was discounted in its entirety as “hypothetical testimony.” This is because the record is devoid of any evidence concerning Trnovsky’s teachings. As 10X acknowledges, Trnovsky and the other references relied upon by the examiner are not in evidence. CRB at 85. Nor does the prosecution history describe Trnovsky’s disclosure in sufficient detail to determine whether the narrowing amendments are tangential to the alleged equivalent. In rejecting application claims 1 and 19 in view of Trnovsky, the examiner did not describe the reference’s teachings, but cited particular portions of Trnovsky. For example, with respect to application claim 19, the examiner’s rejection reads as follows:

Claim 19 is drawn, in part, to an embodiment of the composition of Claim 1 wherein said stimulus is selected from a defined group consisting of a chemical stimulus, a bulk stimulus and a biological stimulus.

¹⁵ The Federal Circuit has held that it is appropriate to rely on “testimony from those skilled in the art as to the interpretation of” the prosecution history “when necessary.” *Festo IX*, 344 F.3d at 1369-70. Such testimony is appropriate for a “complicated paper,” such as Trnovsky. Tr. (Butte) at 431:17-25.

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Trnovsky *et al.* teach these limitations, see ¶s 9 and 102.

JX-0009 at .09778; *see also id.* at .09777 (“Trnovsky *et al.* teach a composition comprising all of the limitations of **Claims 1-2, 4-5, 7-10, 13 and 28-30** see at least the abstract, as well as, ¶s 32, 84, 88, 99 and 102). Nor does the applicants’ response provide any information about Trnovsky’s disclosure other than Trnovsky does not disclose the recited stimuli. JX-0009 at .10009 (“[A]s Claim 21 was rejected only over Kato, Applicant understands that the Office acknowledges that none of Berka, Church, Trnovsky, So, Dominowski and Takanashi teach or disclose ‘wherein said stimulus is selected from the group consisting of a change in pH, a change in ion concentration, reduction of disulfide bonds, and combinations thereof,’ as recited in claims 1, 31, 78, 89, 110 and 118.”).

Based on the foregoing, I find that 10X has not shown that the reason for the narrowing amendment is tangential to the alleged equivalent. Accordingly, 10X is estopped from relying on the DOE to show that the stimulus limitation is satisfied by the accused products.

D. Domestic Industry

10X asserts that each of its domestic industry products practice claims 10, 27, 29, 31, and 33 of the ’204 patent. CIB at 187-188. 10X’s contentions regarding the practice of the ’204 patent by its domestic industry products are undisputed by both Bio-Rad and Staff. SIB at 86 (arguing that the DI products practice the claims at issue); RIB at 136-64 (not addressing the technical prong with respect to the ’204 patent). As set forth below, I find that 10X’s linked-read DI products practice claims 10, 27, 29, 31, and 33 of the ’204 patent and 10X’s single cell DI products practice claims 27, 29, 31, and 33 of the ’204 patent.

1. Claim 10

Claim 10 depends from claim 1 through claims 2, 7, and 8. Claim 1 consists of a preamble and three limitations. To the extent that the preamble is limiting, 10X's DI products provide a "composition." CX-0004C (Butte DWS) at Q/A 369-370. As required by first limitation of claim 1, the DI products provide a plurality of capsules in the form of gel beads. *Id.* at Q/A 372. In accordance with the second limitation of claim 1, the gel beads are situated within droplets in an emulsion. *Id.* at Q/A 374; CX-0538.00002 ("A GEM is a 'Gel bead in EMulsion' droplet that encapsulates each tiny micro-reaction within the Chromium System. Here we show a Single Cell GEM with a single T-cell, reagents and barcoded gel bead all partitioned within a single oil droplet."). As required by third limitation, the gel beads are configured to release their contents (barcoded primers) into the droplets upon application of [REDACTED], which [REDACTED] connecting the barcoded primers to the gel beads. CX-0004C (Butte DWS) at Q/A 376, 378.

As required by claims 2, 7, and 8, in 10X's single-cell DI products, droplets encapsulating a cell containing a plurality of mRNA (a claimed analyte and a polynucleotide) are formed. *Id.* at Q/A 381, 384, and 387. In 10X's linked-read DI products, droplets containing gDNA molecules (a claimed analyte and a polynucleotide) are formed. *Id.*

As required by claim 10, the amount of gDNA provided by 10X's linked-read DI products is sufficient to provide about 100-200X sequence coverage. *Id.* at Q/A 390. 10X, however, does not address how the single-cell DI products satisfy the limitation of claim 10.

Based on the foregoing, I find that 10X's linked-read DI products practice claim 10, but that 10X has failed to show that its single-cell DI products practice claim 10.

2. Claims 27 and 33.

Claims 27 and 33 depend from claim 1, which is discussed above with respect to claim 10. As required by claim 27, each gel bead in 10X's domestic industry products contains millions of barcoded primers that are releasably attached to the bead. *Id.* at Q/A 392. As required by claim 33, the capsules (gel beads) in the domestic industry products are made of a gel. *Id.* at Q/A 370, 372, 374, 376, and 378.

Based on the foregoing, I find that 10X's linked-read DI products and single cell DI products practice claims 27 and 33.

3. Claim 29

Claim 29 depends from claim 23. Claim 23 is consists of a preamble and three limitations. To the extent the preamble is limiting, 10X's DI products provide a "composition." CX-0004C (Butte DWS) at Q/A 395. As required by first limitation of claim 1, the DI products provide a plurality of partitions in the form of gel beads. *Id.* at Q/A 372, 397. As further required by the first limitation, each gel bead is a capsule. *Id.* In accordance with the second limitation, each gel bead is situated within a droplet in an emulsion. *Id.* at Q/A 374, 399; CX-0538.00002 ("A GEM is a 'Gel bead in EMulsion' droplet that encapsulates each tiny micro-reaction within the Chromium System. Here we show a Single Cell GEM with a single T-cell, reagents and barcoded gel bead all partitioned within a single oil droplet."). As required by the third limitation, the gel beads are configured to release their contents in the form of barcoded primers into the droplets upon application of [REDACTED], which [REDACTED] connecting the barcoded primers to the gel beads. CX-0004C (Butte DWS) at Q/A 376, 378, 400. As required by claim 29, each gel bead in 10X's domestic industry products contains millions of barcoded primers that are releasably attached to the bead. *Id.* at Q/A 392, 402.

Based on the foregoing, I find that 10X's linked-read DI products and single cell DI products practice claim 29.

4. Claim 31

Claim 31 depends from claim 25. Claim 25 is a method claim consisting of a preamble and two steps. To the extent the preamble is limiting, 10X's DI products perform a method. CX-0004C (Butte DWS) at Q/A 405. As required by first step of claim 25, the DI products provide a plurality of capsules in the form of gel beads. *Id.* at Q/A 372, 407. Each gel bead is situated within a droplet in an emulsion. *Id.* at Q/A 374, 407; CX-0538.00002 ("A GEM is a 'Gel bead in EMulsion' droplet that encapsulates each tiny micro-reaction within the Chromium System. Here we show a Single Cell GEM with a single T-cell, reagents and barcoded gel bead all partitioned within a single oil droplet."). The gel beads are configured to release their contents (barcoded primers) into the droplets upon application of [REDACTED], which [REDACTED] [REDACTED] connecting the barcoded primers to the gel beads. CX-0004C (Butte DWS) at Q/A 376, 378, 407. As required by the second step, 10X's domestic industry products apply a stimulus to the gel beads provided in the first step, resulting in the gel beads releasing their contents, the barcode primers. *Id.* at Q/A 376, 378, 409. As required by claim 31, each gel bead contains millions of barcoded primers that are releasably attached to the bead. *Id.* at Q/A 392, 411.

Based on the foregoing, I find that 10X's linked-read DI products and single cell DI products practice claim 31.

E. Invalidity

Bio-Rad contends that the asserted claims of the '204 patent are invalid as anticipated or rendered obvious by the '059 patent and/or the Church patent, alone or in combination with

additional prior art. RIB at 145-56. The asserted claims of the '204 patent require either barcode molecules that are releasably attached to a capsule (claims 27, 29, and 31) or a gel bead that is “configured to release” its contents (claim 33). Accordingly, the parties’ arguments regarding invalidity for the '204 patent are substantially identical to those addressed above in the context of the “releasable attachment” limitation of the '024 patent. *See* SRB at 38-39. For the same reasons discussed above, Bio-Rad has failed to show that any asserted claim of the '204 patent is anticipated and/or rendered obvious by the '059 patent and/or the Church patent because these references do not disclose the “releasably attached” or “configured to release” limitations. Moreover, the success of 10X’s domestic industry products further weigh against a finding of obviousness.

VII. THE '530 PATENT

The '530 patent issued on January 2, 2018, naming inventors Benjamin Hindson, Serge Saxonov, Kevin Ness, Paul Hardenbol, Mirna Jarosz, and Michael Schnall-Levin. JX-0007.

A. Asserted Claims

10X is asserting claims 1, 4, 11, 14, 19, 26, and 28 of the '530 patent. Claim 1 is independent and the remaining claims depend directly or indirectly from claim 1. Claim 1 recites:

A method for nucleic acid preparation or analysis, comprising:

(a) providing:

(i) at least 1,000 gel beads;

(ii) releasably attached to each of said at least 1,000 gel beads, at least 1,000 barcode molecules comprising identical barcode sequences that are distinct from barcode sequences of at least 1,000 barcode molecules releasably attached to any other gel bead of said at least 1,000 gel beads; and

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(iii) a plurality of cells each comprising a plurality of polynucleotide molecules;

(b) generating a plurality of droplets, wherein at least 1,000 droplets of said plurality of droplets each comprise:

(i) a single gel bead from said at least 1,000 gel beads; and

(ii) a single cell from said plurality of cells; and

(c) in each of said at least 1,000 droplets, using said plurality of polynucleotide molecules from said single cell and barcode molecules of said at least 1,000 barcode molecules from said single gel bead to generate a plurality of barcoded polynucleotide molecules,

wherein said barcode molecules become detached from said gel bead.

Id., col. 47:58-67, col. 48:57-col. 49:4.

Claim 4 depends from claim 1 through unasserted claim 3. Claim 3 requires that the polynucleotide molecules be mRNA. *Id.*, col. 49:8-10. Claim 4 further requires that the barcoded polynucleotide molecules be generated by reverse transcribing the mRNA in the presence of the barcode molecules. *Id.*, col. 49:11-14. Claim 19 depends from claim 1 through unasserted claim 17. Claim 17 requires that the barcode molecules “comprise combinatorial assemblies of sequences from sequence modules.” *Id.*, col. 50:5-7. Claim 19 further requires that each of the combinatorial assemblies comprise a first sequence, a second sequence, and a third sequence. *Id.*, col. 50:13-15.

Claims 11, 14, 26, and 28 depend directly from claim 1. Claim 11 requires that the barcode molecules in each of the droplets be released from a single gel bead. *Id.*, col. 49:34-36. Claim 14 requires that each gel bead have “disposed within” it at least 1,000 barcode molecules. *Id.*, col. 49:44-45. Claim 26 requires that each gel bead contain at least 1,000,000 barcode

molecules. *Id.*, col. 50:30-31. Claim 28 requires that the barcode molecules become detached before the generation of the barcoded polynucleotide molecules. *Id.*, col. 50:35-37.

B. Claim Construction

The parties agreed to construe “barcode” to mean a “label that may be attached to an analyte to convey identifying information about the analyte.” Order No. 22 at 2. They agreed that the term “wherein said barcode molecules become detached from said gel bead” has its plain and ordinary meaning. *Id.* In the *Markman* order, the term “amplifying” was construed to mean “increasing the number of copies of the target sequence to be detected,” including by reverse transcription. *Id.* at 31-45. The terms “providing,” “said at least 1,000 droplets,” and “a plurality of cells” were given their plain and ordinary meaning, with a requirement that all of the “at least 1,000 droplets” in the second step be generated before the third step of the claim is performed on any of “said at least 1,000 droplets.” *Id.* at 45-51. In Order No. 35, this claim construction was further clarified so that it does preclude the generation of some barcoded molecules before the start of the claimed third step. Order No. 35 at 4-6 (Mar. 5, 2019).

C. Infringement

10X is asserting claims 1, 4, 11, 14, 19, 26, and 28 of the ’530 patent against Bio-Rad’s “ddSEQ Cartridges (v1 [REDACTED]), ddSEQ Single-Cell Isolator (v1 [REDACTED]), ddSEQ Cartridge Holder, and consumables and assays used with and/or as part of Bio-Rad’s ddSEQ v1 [REDACTED] 2 products including SureCell WTA 3’ (also referred to as WTA 3’ v1), [REDACTED]

1. Claim 1

As discussed in the *Markman* order, claim 1 is directed to a three-step method. Order No. 22 (Oct. 31, 2018) at 44. The first step requires “providing” at least 1,000 gel beads with

“releasably attached” barcode molecules and “a plurality of cells” containing polynucleotides. ’530 patent, col. 47:60-67 & col. 48:58-64. The second step requires generating “a plurality of droplets, wherein at least 1,000 droplets of said plurality of droplets each” have “a single gel bead from said plurality of cells” and “a single cell from said plurality of cells.” *Id.*, col. 48:60-64. The third step requires using the polynucleotide molecules and barcode molecules to form “a plurality of barcoded polynucleotide molecules” “in each of said 1,000 droplets.” *Id.*, col. 48:65-col. 49:4. As found in the *Markman* Order, the second step of generating “at least 1,000 droplets” must be completed before the third step of generating a “plurality of barcoded polynucleotide molecules” is performed in any of the droplets. Order No. 22 (Oct. 22, 2018) at 51.

a. Preamble

To the extent that the preamble is limiting, there is no dispute that the accused products are methods of nucleic acid preparation and analysis or are used in such methods. ’530 patent, col. 47:58-59. Specifically, Bio-Rad’s ddSEQ v1 products are used with the WTA 3’v1 assay to prepare the mRNA of a single cell for single cell whole transcriptome analysis. *See* CX-0004C (Butte DWS) at Q/A 68 (describing the release and barcoding of mRNA from cell in the WTA 3’ v1 assay’s workflow). [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] *See* CX-0004C (Butte DWS) at Q/A 68 (describing the release and barcoding of mRNA from cell in the WTA 3’ v1 assay’s workflow), 84 [REDACTED]

performs the same work flow as the WTA 3' v1 assay to partition and barcode the mRNA transcripts of individual cells.”), 93 (In the scATAC-seq assay, “[t]he oligonucleotide barcodes are released from the gel bead [REDACTED] and attach to the genomic DNA fragments for amplification through PCR in the droplet”), 100 ([REDACTED])

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]; JX-0091C.00006-.00007

(describing the workflow of the scATAC-seq assay); CX-1491C.00013-.00016 (describing the

WTA 3' v1 assay); JX-0105C.00024 ([REDACTED])

b. Step 1: “providing” a plurality of cells and at least 1,000 gel beads

The first step of claim 1 requires “providing” at least 1,000 gel beads and a plurality of cells. ’530 patent, col. 47:60-67 & col. 48:57-58. Each gel bead must have “releasably attached” to it “at least 1,000 barcode molecules comprising identical barcode sequences.” *Id.* at col. 47:62-67. The barcode sequences of barcode molecules attached to each bead must be distinct from the barcode sequences of the barcode molecules attached to any other bead. *Id.* Each cell must “compris[e] a plurality of polynucleotide molecules.” *Id.* at col. 48:57-58.

There is no dispute that the accused products can be used to provide at least 1,000 gel beads and a plurality of cells. The accused products use gel beads. CX-0004C at Q/A 489 (“[T]he ddSEQ v1 products provide gel beads composed of polyacrylamide and users provide these gel beads in performing the claimed method.”), 491 ([REDACTED]) [REDACTED]). The accused products have the ability to provide at least 1,000 gel beads

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and a corresponding number of cells. CX-0004C (Butte DWS) at Q/A 490 (testifying that Bio-Rad's ddSEQ v1 products provide at least 1,000 beads and an equal number of cells); 492

[REDACTED], 493 (testifying that Bio-Rad's scATAC-seq assay using the v1 cartridge provide at least 1,000 beads and an equal number of cells); JX-0036.00002-00003 (data sheet showing that 1,384 single cells were barcoded in one WTA 3' v1 assay); CX-1573C (18,000 cells processed in WTA 3' v1 assays); CX-1529C.00037 [REDACTED]

[REDACTED]

The cells provided by the accused products contain a plurality of polynucleotide molecules. CX-0004C (Butte DWS) at 502 (testifying that the cells provided by the ddSEQ v1 products comprise a plurality of mRNA molecules), 504 ([REDACTED])

[REDACTED]

Although Bio-Rad disputes whether the barcode molecules are releasably attached to the gel beads, here is no dispute that each of the gel beads has at least 1,000 barcode molecules attached to it. CX-0004C (Butte DWS) at 496; JX-0036.00004 (showing at least 3,000 genes are detected per cell and thus confirming at least 3,000 barcode molecules per bead). The barcode molecules have barcode sequences in the form of oligonucleotide molecules. CX-0004C (Butte DWS) at Q/A 127 (testifying that "oligonucleotide molecules released from the gel beads in Bio-Rad's ddSEQ v1 products each include a Cell Barcode sequence") ('024 patent, claim 1),

130 ([REDACTED]), 131 (testifying that “[t]he claimed oligonucleotide molecules in the ATAC-seq assay” include a barcode sequence). The barcode molecules attached to each gel bead have barcode sequences that are distinct from the sequences of barcode molecules attached to other gel beads. CX-0004C (Butte DWS) at Q/A 497. In particular, for the ddSEQ v1 products, there are almost [REDACTED] pools of barcode molecules and each pool of barcode molecules has a unique barcode sequence. *Id.*; JX-0050C.00026; CX-0018C (Lebofsky Depo. Tr.) at 115:13-116:4. [REDACTED] CX-0004C (Butte DWS) at Q/A 497; CX-0009C (Agresti Dep. Tr.) at 437:1-7.

The barcode molecules are releasably attached to the gel bead through a [REDACTED] [REDACTED] CX-0004C (Butte DWS) at Q/A 143 (ddSEQ v1 products), 160 ([REDACTED]); JX-0036.00001 (“Comprehensive Single-Cell RNA Sequencing Workflow”). Bio-Rad disputes that its products satisfy the “releasably attached” requirement for the same reasons that it contested that the requirement was satisfied with respect to the asserted claims of the ’024 and ’468 patents. Bio-Rad’s argument is rejected for the same reasons that it was rejected with respect to the ’024 and ’468 patents.

For the foregoing reasons, I find that the accused products satisfy the first step of claim 1.

c. Step 2: “generating a plurality of droplets”

The second step of claim 1 requires generating a plurality of droplets, wherein at least 1,000 of the droplets comprise a “single gel bead” and a “single cell.” ’530 patent, col. 48 59-64. The accused products are capable of producing a plurality of droplets. CX-0004C (Butte DWS)

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at Q/A 508-509; CX-1357C.00018; JX-0050C.00014 (ddSEQ v1 products provide between 50,000-75,000 droplets for each sample, and about 260,000 droplets per chip); CX-

1529C.00037; JX-0110C.00006 ([REDACTED]

[REDACTED]); CX-0018C at 197:24-198:5.

The accused systems can be used to generate at least 1,000 droplets with a cell and gel bead. When all four lanes are primed with a Cell Suspension Mixture, the ddSEQ v1 cartridge can generate approximately 1,200 droplets having a cell and a gel bead. CX-0004C (Butte DWS) at Q/A 512; JX-0035.00011 (requirement of 40,000 input cells for 1,200 processed cells); CX-0016C (Kaihara Depo. Tr.) at 166:21-167:17 (testifying that most users have [REDACTED] to input into a ddSEQ v1 cartridge); JX-0036.00002-03 (1,384 droplets containing a single cell and a gel bead generated using one ddSEQ v1 cartridge); CX-1494C.00016 ([REDACTED] [REDACTED]). If the scATAC-seq assay is performed using the ddSEQ v1 cartridge, each lane is capable of generating 500 droplets with a cell and gel bead. CX-0016C (Kaihara Depo. Tr.) at 155:15-158:25; CX-0004C (Butte DWS) at Q/A 515-516. [REDACTED]

[REDACTED]. CX-0004C (Butte DWS) at Q/A 513; CX-1529C.00037.

Bio-Rad does not dispute that the accused products are capable of generating at least 1,000 droplets containing a cell and gel bead. Instead, Bio-Rad argues that the accused products do not satisfy the second step of claim 1 because they do not generate a “collection” of at least 1,000 of such droplets. RIB at 194-95. Bio-Rad argues that droplets are formed one-by-one in each chamber of the ddSEQ v1 [REDACTED] cartridge and, after each droplet is formed, the cell in the droplet is “destroyed almost immediately.” RX-0665C (Metzker RWS) at Q/A 100 (“Think of it

this way, as droplet number one forms with a cell and a gel bead in it, the cell is destroyed almost immediately because the cell lysis reagent acts on the cell membrane. So, you never form a collection of 1,000 droplets containing a single cell and a single gel bead before any barcoding begins.”). As a result, Bio-Rad argues, that there is never an instant of time where there is at least 1,000 droplets with a cell and gel bead. Bio-Rad’s non-infringement argument reads a limitation into the claim that is not present, viz., that a collection of at least 1,000 droplets with a cell and gel bead must exist in some instant of time.


Neither the claim language nor the *Markman* order require amassing such a “collection.” The claim language and *Markman* order only require that all of the droplets be generated prior to proceeding to the third step. ’530 patent, col. 48:59-64 (“generating a plurality of droplets, wherein at least 1,000 droplets of said plurality of droplets each comprise” a single gel bead and a single cell); Order No. 22 (Oct. 31, 2019) at 48 (“The second step of claim 1’s three-step method requires the generation of ‘at least 1,000 droplets’”). Although the step of generating droplets with a cell and gel bead must be completed before the start of the third step, the third step does not require at least 1,000 droplets having a cell and a gel bead. The third step requires at least 1,000 droplets containing (1) a plurality of polynucleotide molecules from a single cell and (2) the barcode molecules from a single bead. ’530 patent, col. 48:65-col. 49:2. Therefore, even if the cells are lysed almost immediately after droplet formation so that there is never more than a handful of droplets with a cell and gel bead at any single point in time, the claim language is still satisfied so long as at least 1,000 of such droplets had been generated before the start of the third step.

Based on the foregoing, I find that the accused products satisfy the second step of claim 1.

d. Step 3: generating a plurality of “barcoded polynucleotide molecules”

The third step requires that, in each of said at least 1,000 droplets, a plurality of barcoded polynucleotide molecules be generated using the polynucleotide molecules from the cell and the barcode molecules from the gel bead. '530 patent, col. 48:65-col. 49:2. The step further requires that the “barcode molecules become detached from said gel bead.” *Id.* at col. 49:3-4.

There does not appear to be a dispute that in each droplet containing a single cell and single gel bead the following processes occur: (1) the cell lyses and releases polynucleotide molecules in the form of mRNA or gDNA into the droplet; (2) [REDACTED] the barcode molecules from the gel bead; (3) the released barcode molecules bind with either mRNA (WTA 3' v1, [REDACTED]) or tagged gDNA fragments (scATAC-seq assay); and (4) the barcode molecules and polynucleotide molecules are used as templates to generate either barcoded cDNA (WTA 3' v1, [REDACTED]) or barcoded gDNA (scATAC-seq assay).



JX-0075C.00018 (describing the WTA 3' v1 assay); *see also* JX-0074C.00009 (describing the WTA 3' v1 assay); JX-0088C.00015 (describing the WTA 3' v1 assay); JX-0091C.00020

(describing the scATAC-seq assay); CX-1491C.00018 (describing the scATAC-seq assay); JX-0034.00027, 00031, 00037 CX-0004C (Butte DWS) at Q/A 198-200, 204-209, 519, 523; CX-0018C (Lebofsky Depo. Tr.) at 154:7-157:22, 160:8-161:18; CX-0019C (Norton Depo. Tr.) at 194:24-195:13.

According to 10X, the third step occurs when the droplets are heated on a thermal cycler. Bio-Rad argues that 10X has not shown that a plurality of polynucleotide molecules are barcoded in each of at least 1,000 droplets while the droplets are being incubated on the thermal cycler. RIB at 196. According to Bio-Rad, the enzymes in the droplets “are active and start reacting to form barcoded molecules immediately upon droplet formation” and suggests—but does not state—that all of the barcoding is completed in a subset of the droplets prior to incubation, so that barcoded polynucleotides are generated in less than 1,000 droplets during the incubation step. *Id.*

With regard to the WTA 3' v1, [REDACTED], Bio-Rad's documentation indicates that barcoded cDNA is generated when the droplets are incubated in accordance to the thermal cycler's “Reverse Transcription (RT) program.”

[REDACTED]

JX-0088C.00015; *see also* JX-0034.00043 (SureCell WTA 3' Library Prep Reference Guide)

("Cell lysis and cell barcoding of mRNA transcripts takes place in each droplet during reverse transcription."), 00025 ("**Reverse Transcribe Samples** This step reverse transcribes samples on a thermal cycler,"), .00026 ("Save the following Reverse Transcription (RT) program on a thermal cycler . . .").

The thermal cycler's reverse transcription program heats the droplets at 37°C for 30 minutes and then heats the droplets at 50°C for 60 minutes. JX0034.00026. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. This evidence supports 10X's position that the following processes occur in the thermal cycler: (1) the release of the barcode molecules from the gel bead and (2) the generation of barcoded polynucleotides through reverse transcription.

With regard to the scATAC-seq assay, Dr. Ronald Lebofsky—who holds the position R&D Manager II at Bio-Rad and [REDACTED]—confirmed that barcoded polynucleotides are generated during the first heating cycle of the thermal cycler. CX-0018C (Lebofsky Depo. Tr.) at 157:8-16, 159:24-160:9.

Bio-Rad dismisses the statements in its own documents as “general statements,” but does not point to any persuasive evidence countering those statements. RIB at 109. Bio-Rad primarily relies on the testimony of its expert Dr. Metzger, who testifies that [REDACTED]
[REDACTED]
[REDACTED] RX-0665C (Metzker RWS) at Q/A 97-98. Dr. Metzger also testifies that [REDACTED] the barcode molecules from the gel bead soon after the droplet is formed. *Id.* Dr. Metzger, however, does not state that these processes are completed before the droplets are incubated on the thermal cycler, only that the processes start before incubation. *Id.* at Q/A 97-108. In support of its argument, Bio-Rad also points to the hearing testimony of 10X’s expert, who testified that the reverse transcriptase used in the accused products may exhibit a “small element” of activity at room temperature. Tr. (Butte) at 397:7-12. As discussed above, however, Bio-Rad’s own documents clearly show that [REDACTED]
[REDACTED] primarily occur during incubation.

Assuming *arguendo* that Dr. Metzger is correct and [REDACTED] and reverse transcriptase are active as soon as droplets are formed in the single-cell isolator, the enzymes would be active only for a relatively short period of time at a suboptimal temperature. The single-cell isolator operates at room temperature (~20°C) and completes a run within five

minutes. CX-0004C (Butte DWS) at Q/A 526; JX-0075C.00016; JX-0034 (“Single-cell isolation begins automatically after the ddSEQ Single-Cell Isolator door is closed and takes approximately 5 minutes.”). In that period of time, for Bio-Rad’s argument to hold true, the [REDACTED] and reverse transcriptase must not only be active, but they must reach a point where all the barcoded molecules have been cleaved from the gel bead and/or the reverse transcriptase has finished forming barcoded cDNA in a sufficient number of droplets so that these processes occur in less than 1,000 droplets during incubation. As shown by their product labels, however, room temperature is a suboptimal temperature for both the [REDACTED] and the reverse transcriptase used in the accused products. The reaction temperature of the [REDACTED] (37°C) is significantly higher than room temperature (20°C) and the optimal reaction temperature of the reverse transcriptase is higher still (50-55°C). JX-0050C.00056. Moreover, the period of time that droplets are being generated in the single-cell isolator is short relative to the periods of time that the droplets are being incubated. Specifically, the droplets are incubated at 37°C (the [REDACTED] reaction temperature) for 30 minutes and then heated at 50°C (the reverse transcriptase’s optimal reaction temperature) for another 60 minutes. JX-0034C.00026. There is no evidence suggesting that the single-cell isolator’s give-minute run-time provides the enzymes sufficient time to finish catalyzing their reactions within the droplets, especially at a suboptimal temperature.

On the basis of this evidence, I find that 10X has shown by the preponderance of the evidence that at least the bulk of the following processes occur while the droplets are being heated on the thermal cycler: (1) the [REDACTED] release the barcode molecules from the gel bead and (2) the reverse transcription of barcoded cDNA from mRNA and barcode molecules. Accordingly, I find that the accused products satisfy the third step of claim 1 and infringe

claim 1.

2. Claims 4, 11, 14, 19, 26, and 28

Claim 4, 11, 14, 19, 26, and 28 depend either directly or indirectly from claim 1.

a. Claim 4

Claim 4 depends from claim 1 through unasserted claim 3. Claim 3 requires that the polynucleotide molecules be mRNA. '530 patent, col. 49:8-10. Claim 4 further requires that the third step of claim 1 comprise reverse transcribing "said plurality of mRNA molecules in presence of said barcode molecules to generate said plurality of barcoded polynucleotide molecules." '530 patent, col. 49:11-14. As discussed above, the WTA 3' v1, WTA 3' v2, and CITE-seq assays generate barcoded cDNA by reverse transcribing mRNA in the presence of barcode molecules. *See, e.g.*, JX-0075C.00018 (describing the WTA 3' v1 assay); JX-0074C.00009 (describing the WTA 3' v1 assay); JX-0088C.00015; JX-0034.00027, 00031, 00037; CX-0004C (Butte DWS) at Q/A 198-200, 204-209, 519, 523; CX-0018C (Lebofsky Depo. Tr.) at 154:7-157:22, 160:8-161:18; CX-0019C (Norton Depo. Tr.) at 194:24-195:13. With regard to the scATAC-seq assay, however, gDNA fragments, not mRNA, are barcoded and the assay does not form barcoded polynucleotides through reverse transcription. *See, e.g.*, JX-0091C.00020; CX-1491C.00018.

For the foregoing reasons, I find that WTA 3' v1, [REDACTED] infringe claim 4. I further find that the scATAC-seq assay does not infringe claim 4.

b. Claim 11

Claim 11 depends directly from claim 1 and requires that the barcode molecules be released from the gel bead. '530 patent, col. 49:34-36. As discussed above, in the WTA 3' v1, [REDACTED] and scATAC-seq assays, [REDACTED] the barcode molecules

from the gel bead. *See supra*. Accordingly, I find that the accused assays infringe claim 11.

c. Claim 14

Claim 14 requires that there be at least 1,000 barcode molecules “disposed within” each gel bead. ’530 patent, col. 49:44-45. The gel beads used in the accused products are formed from polyacrylamide, which is a polymer hydrogel formed by polymerization of acrylamide monomers, acrydite oligos and crosslinker methylene-bis-acrylamide in water. CX-0004C (Butte DWS) at Q/A 116-17, 122-23; JX-0101C.00006. Each gel bead is porous having a three-dimensional network of pores. *Id.* The gel beads are created by combining the acrylamide pre-mix and barcode molecules, which results in barcode molecules bonded throughout each gel bead. CX-1548C.00006. Each resulting bead has at least 1,000,000 barcode molecules disposed within the bead. CX-0004C (Butte DWS) at Q/A 128-31, 133, 546-47; JX-0101C.00006 (“Entire volume is accessible.”). Accordingly, I find that the WTA 3’ v1, [REDACTED], and scATAC-seq assays infringe claim 14.

d. Claim 19

Claim 19 depends from claim 1 through unasserted claim 17. Claim 17 requires that the barcode molecules “comprise combinatorial assemblies of sequences from sequence modules.” *Id.*, col. 50:5-7. Claim 19 further requires that the combinatorial assemblies have a first sequence, a second sequence, and a third sequence. *Id.*, col. 50:13-15. The barcode molecules in the accused products comprise [REDACTED]. JX-0105C.00021; JX-0075C.00018; CX-0004C (Butte DWS) at Q/A 550-51; JX-0101C.0007-.00008. Accordingly, I find that the WTA 3’ v1, [REDACTED], and scATAC-seq assays infringe claim 19.

e. Claim 26

Claim 26 depends directly from claim 1 and requires that the gel beads have at least 1,000,000 barcode molecules. '530 patent, col. 50:30-31. The gel beads in the accused assays have over 1,000,000 barcode molecules. CX-0004C (Butte DWS) at Q/A 128-29; JX-0050C.00026; JX-0105C.00020-.00022. Accordingly, I find that the WTA 3' v1, [REDACTED], and scATAC-seq assays infringe claim 26.

f. Claim 28

Claim 28 depends directly from claim 1 and requires that the barcode molecules be released from the gel bead before the formation of the barcoded polynucleotide molecules. '530 patent, col. 50:35-37. In the accused assays, the [REDACTED] severs the barcode molecules from the gel bead before the generation of barcoded cDNA strands and barcoded gDNA fragments. CX-0004C (Butte DWS) at Q/A 557-559; *see, e.g.*, JX-0075C.00018. Accordingly, I find that the WTA 3' v1, [REDACTED], and scATAC-seq assays infringe claim 28.

3. Indirect Infringement

10X alleges that Bio-Rad indirectly infringed the asserted claims by inducing infringement or through contributory infringement.

a. Underlying Acts of Direct Infringement

Both induced infringement and contributory infringement require an act of direct infringement. *Carborundum Co. v. Molten Metal Equip. Innovations, Inc.*, 72 F.3d 872, 876 n.4 (Fed. Cir. 1995) ("Absent direct infringement of the claims of a patent, there can be neither contributory infringement nor inducement of infringement.") (quoting *Met-Coil Sys. Corp. v. Korners Unlimited, Inc.*, 803 F.2d 684, 687 (Fed. Cir. 1986)) (internal quotation marks omitted). Moreover, the act of direct infringement must be by an entity other than Bio-Rad. *AIDS*

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Healthcare Found., Inc. v. Gilead Sci., Inc., 890 F.3d 986, 992-93 (Fed. Cir. 2018) (“Liability for induced infringement requires that some other entity is directly infringing the patent.”); *Spanion, Inc. v. Int’l Trade Com’n*, 629 F.3d 1331, 1352 (Fed. Cir. 2010) (“[T]o prevail on contributory infringement in a Section 337 case, the complainant must show: . . . the accused infringer imported, sold for importation, or sold after importation within the United States, the accused components that contributed to another’s direct infringement.”).

With Bio-Rad’s assistance, Berkeley researchers performed SureCell 3' WTA assays, using 12 ddSEQ v1 cartridges. CX-1573.00001. The researchers were able to obtain barcoded cDNA from a total of 18,000 cells resulting in an average of 1500 cells being barcoded per cartridge. *Id.* at .00002-.00003. In addition, [REDACTED]
[REDACTED]
[REDACTED]. CX-1494C.00016. A Bio-Rad document describes another experiment in which a SureCell 3' WTA assay was conducted using a single ddSEQ v1 cartridge. JX-0036.00002-.00003. The experiment resulted in 1,384 cells being barcoded. *Id.* at .00003. 10X, however, has not pointed to any evidence showing that the SureCell 3' WTA assay was used with [REDACTED]. Accordingly, I find that the SureCell 3' WTA assay has been used with the ddSEQ v1 products to infringe the asserted claims. I further find that 10X has not shown that the SureCell 3' WTA assay has been used with [REDACTED] to infringe the asserted claims.

Although there is testimony indicating that the [REDACTED]
[REDACTED], the testimony does not provide sufficient details that would allow for a determination of whether this was an infringing use. It is possible to use the ddSEQ v1 cartridge in a non-infringing manner by using only a subset of

cartridge's four chambers to conduct an assay. Using only a subset of the chambers will fall outside the scope of the claims because the cartridge will not produce at least 1,000 droplets containing a cell and gel bead. *See, e.g.*, JX-0034.00005 (teaching that, if primed with input cells, each chamber will produce approximately 300 droplets with one cell and one gel bead), .00017 (providing instructions on how to use cartridge without priming all of the chambers with cells). At least one or two of Bio-Rad's customers have so used the ddSEQ v1 cartridge. CX-0016C (Kaihara Depo. Tr.) at 167:18-168:3. There is no evidence regarding the methodology employed with running the [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

With regard to the scATAC-seq assay, in September 19, 2018, Bio-Rad made the scATAC-seq assay available to its "Early Access Customers" for use with the ddSEQ v1 system. CX-1739C; *see also*, CX-0004 (Butte DWS) at Q/A 95. There is, however, no evidence of any of the "Early Access Customers" purchasing, much less using, the scATAC-seq assay for use with the ddSEQ v1 system. As discussed above, although the scATAC-seq [REDACTED]

[REDACTED]

[REDACTED]. Tr. (Kaihara) at 275:2-6; CX-0016C (Kaihara Depo. Tr.) at 148:13-19. Accordingly, I find that 10X has not shown that the scATAC-seq assay has been used with [REDACTED] the ddSEQ

v1 system [REDACTED] system to infringe the asserted claims of the '530 patent.¹⁶

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Based on the foregoing, the only acts of direct infringement by entities other than Bio-Rad involve the 3' WTA v1 assay used with the ddSEQ v1 system.

b. Induced Infringement

For induced infringement, 10X must show that Bio-Rad acted to induce infringement of the asserted claims and that it was aware “that the induced acts constitute[d] patent infringement.” *Global-Tech*, 563 U.S. at 760-66. As confirmed by the testimony of Bio-Rad witnesses, Bio-Rad actively induced end-users to infringe the asserted claims by using the 3' WTA v1 assay with the ddSEQ v1 system. *See, e.g.*, CX-0019C (Norton Depo. Tr.) at 32:6-11 (testifying that Bio-Rad will “generally train the customer after they purchase the system”), 32:15-33:4 (testifying that Bio-Rad demonstrated the ddSEQ v1 system to each of its customers and that the demonstrations taught the customers “each step of the workflow to use the ddSEQ system”). Bio-Rad provides customers with specific instructions on how to perform the 3' WTA v1 by priming all four chambers of the ddSEQ v1 cartridge with cells. JX-0034.00017 (“To load the same cell sample across all 4 chambers, make a Cell Suspension Mix using the volumes listed for 1 cartridge.”). As discussed above, if all four chambers are primed with cells, the

¹⁶ [REDACTED]
[REDACTED]. Bio-Rad’s own acts of direct infringement, however, cannot be relied upon to support a finding of indirect infringement. *AIDS Healthcare*, 890 F.3d at 992-93; *Spanson*, 629 F.3d at 1352.

cartridge will generate approximately 1,200 droplets containing a cell and gel bead.

With regard to Bio-Rad's knowledge that the induced acts constituted patent infringement, Bio-Rad was aware of the 10X's infringement allegations and "the '530 Patent as of at least January 15, 2018, when 10X served its summons and complaint in *10X Genomics, Inc. v. Bio-Rad Labs., Inc.*, Case No. 3:18-cv-00209 (N.D. Cal. Jan. 9, 2018)." Bio-Rad's Response to the Complaint (Mar. 6, 2018), ¶ 86. With regard to whether Bio-Rad knew that the acts that induced were intended to cause a third party to infringe the '530 patent, there is no evidence that Bio-Rad sought and obtained a non-infringement opinion. Bio-Rad's failure to do so is circumstantial evidence that it was aware that the acts brought about by its conduct would infringe the '530 patent. *See, e.g., Broadcom Corp. v. Qualcomm Inc.*, 543 F.3d 683, 699 (Fed. Cir. 2008) (failure to procure a non-infringement opinion is "circumstantial evidence of intent to infringe").

Based on the foregoing, I find that Bio-Rad induced infringement of the asserted claims of the '530 patent by inducing others to use the 3' WTA v1 assay with the ddSEQ v1 system.

c. Contributory Infringement

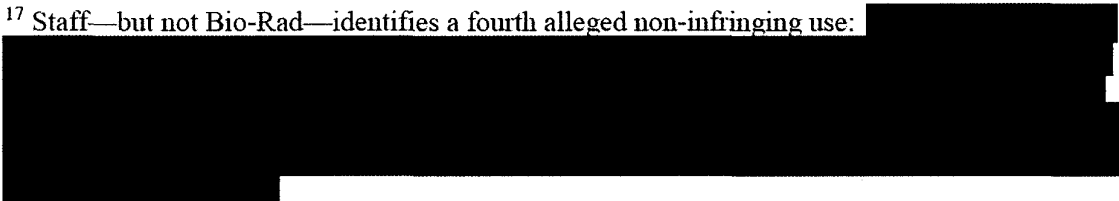
"[T]o prevail on contributory infringement in a Section 337 case, the complainant must show *inter alia*: (1) there is an act of direct infringement in violation of Section 337; (2) the accused device has no substantial non-infringing uses; and (3) the accused infringer imported, sold for importation, or sold after importation within the United States, the accused components that contributed to another's direct infringement." *Spansion*, 629 F.3d at 1353. With regard to the first and third elements, as discussed above, Bio-Rad "imported, sold for importation, or sold after importation within the United States" the 3' WTA v1 assay and the ddSEQ v1 products, which were used by others to infringe the asserted claims of the '530 patent.

With regard to the second element identified by the *Spanston* court, it is 10X's burden to show "that there are no substantial non-infringing uses" of the accused system. *Toshiba Corp. v. Imation Corp.*, 681 F.3d 1358, 1362 (Fed. Cir. 2012) (citing 35 U.S.C. § 271(c)). Pointing to three uses for the accused product that it contends are substantial and non-infringing, Bio-Rad argues that 10X has not met its burden.¹⁷ "[N]on-infringing uses are substantial when they are not unusual, far-fetched, illusory, impractical, occasional, aberrant, or experimental." *Id.* (quoting *Vita-Mix Corp. v. Basic Holding, Inc.*, 581 F.3d 1317, 1327 (Fed. Cir. 2009) (internal quotation marks omitted)). "In assessing whether a use is substantial, the fact-finder may consider 'the use's frequency, . . . the use's practicality, the invention's intended purpose, and the intended market.'" *Id.* (quoting *i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 851 (Fed. Cir. 2010)) (omission in original).

The first use that Bio-Rad contends is substantial and non-infringing is the DROP-seq assay. This assay and Bio-Rad's contentions are addressed above. I find that the DROP-seq assay is not a substantial, non-infringing use of the accused ddSEQ v1 products with respect to the asserted claims of the '530 patent for the same reasons that it does not constitute such a use with the respect to the '024 patent.

The second alleged substantial non-infringing use is processing samples using less than all four chambers of the ddSEQ v1 cartridge. The asserted claims require the generation of at least 1,000 droplets containing a single cell and a single gel bead. '530 patent, col. 48:65-col.

¹⁷ Staff—but not Bio-Rad—identifies a fourth alleged non-infringing use:



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49:2 (claim 1). The ddSEQ v1 cartridge has four chambers and each chamber is capable of producing an average of 300 droplets containing a cell and gel bead. JX-0034.0005.

Accordingly, if less than four of the chambers are used, the ddSEQ v1 cartridge will generate less than 1,000 droplets containing a cell and a gel bead. RX-0665 (Metzker DWS) at Q/A 148. Bio-Rad provides instructions on how to use the cartridge without using all four chambers to process samples:

All 4 sample chambers must be loaded with Cell Suspension Mix.
If you choose not to load any cells into a chamber, prepare and load the Cell Suspension Mix, substituting an equivalent volume 1X PBS + 0.1% BSA in place of Filtered Cells.

JX-0034.00017.

Although it is possible to use the ddSEQ v1 cartridge without using all four chambers, the evidence indicates that such usage would be an uncommon practice at best. In order to generate 1,200 droplets containing a cell and gel bead, Bio-Rad teaches that each of the four chambers should be loaded with between 10,125-12,375 cells. JX-0034.00012. It is Bio-Rad's expectation that its customers will use all four chambers and it counsels potential customers with less than 40,000 cells that the ddSEQ v1 "system is not right for them." JX-0016C (Kaihara Depo. Tr.) at 167:5-17. [REDACTED] *Id.* at 167:18-22. [REDACTED]

[REDACTED] Accordingly, I find that using less than all four chambers of the ddSEQ v1 cartridge for an assay is not a substantial use of the ddSEQ v1 cartridge.

The third alleged substantial non-infringing use is performing the scATAC-seq assay using purified nuclei, instead of cells. While the scATAC-seq assay can be used to generate droplets containing a cell and gel bead, it can also be used to generate droplets containing purified nuclei and a gel bead. CX-0004C (Butte DWS) at Q/A 92 ("The scATAC-seq assay can

partition either whole cells or purified nuclei for analysis.”). Using the assay to encapsulate nuclei instead of cells is a non-infringing use because the claims require the generation of droplets containing a cell and gel bead. ’530 patent, col. 48:59-63.

10X does not dispute that using the assay to encapsulate purified nuclei is a non-infringing use, but takes the position that “[t]here is no substantial use of scATAC-seq with isolated nuclei.” CIB at 233. In support of its position, 10X argues that “using isolated nuclei rather than single cells is merely an option for scATAC-seq” and that “all use of scATAC-seq is at most [REDACTED].” *Id.* 10X’s argument is unpersuasive. Although Bio-Rad has not fully released the scATAC-seq assay, on September 19, 2018 Bio-Rad started to offer the assay to “Early Access Customers” for use with the ddSEQ v1 system. CX-1739C; CX-0004 (Butte DWS) at Q/A 95. Although using the assay with nuclei instead of cells may only be an “option,” it is an option customers will likely select in particular situations. Bio-Rad developed alternate protocols for the scATAC-seq assay—one using cells and one using nuclei—because for certain types of cells “one would work better than the other.” CX-0018C (Lebofsky Depo. Tr.) at 157:24-158:16. End users would be expected to use nuclei with the scATAC-seq assay in those instances where using nuclei “would work better” than using intact cells and *vice versa*.

Based on the foregoing, I find that 10X has failed to show that using the scATAC-seq assay with isolated nuclei is not a substantial non-infringing use of the ddSEQ v1 products.¹⁸

¹⁸ Pointing to the hearing testimony of Dr. Kaihara, Staff argues that using the scATAC assay with nuclei is not a substantial non-infringing use of the ddSEQ v1 products because “[t]he evidence shows that ATAC-seq on the v1 products, [REDACTED]

[REDACTED] SIB at 105. Although Staff correctly characterizes Dr. Kaihara’s testimony, it ignores that Bio-Rad offered the scATAC assay to its customers for use with the ddSEQ v1 products. CX-1739C; CX-0004 (Butte DWS) at Q/A 95.

D. Domestic Industry

10X asserts that its single-cell domestic industry products practice claims 1, 4, 11, 14, 19, 26, and 28 of the '530 patent.

1. Claim 1

a. Preamble

To the extent that the preamble is limiting, there is no dispute that the domestic industry products either are methods of nucleic acid preparation and analysis or are used in such methods. '530 patent, col. 47:58-59. Specifically, 10X's single cell applications are used to prepare cell samples for transcriptome analysis. CX-0004C (Butte DWS) at Q/A 564.

b. Step 1: "providing" a plurality of cells and at least 1,000 gel beads

There is no dispute that the domestic industry products provide at least 1,000 gel beads and a plurality of cells. *See, e.g.*, CX-0477.00001 ("Within each microfluidic channel, ~100,000 GEMs are formed per ~6-min run, encapsulating thousands of cells in GEMs."), .00002 ("The core of the technology is a Gel bead in EMulsion (GEM). GEM generation takes place in an 8-channel microfluidic chip that encapsulates single gel beads at ~80% fill rate . . ."); CX-0004C (Butte DWS) at Q/A 566. Each cell contains a plurality of polynucleotides in the form of mRNA. CX-0004C (Butte DWS) at Q/A 260, 570; CX-0481.00015; CX-0477.00004. Each gel bead has millions of barcode molecules attached to it. CX-0447.00002 ("Each gel bead is functionalized with barcoded oligonucleotides that consists of: (i) sequencing adapters and primers, (ii) a 14 bp barcode drawn from ~750,000 designed sequences to index GEMs, (iii) a 10 bp randomer to index molecules (unique molecular identifier, UMI) and (iv) an anchored 30 bp oligo-dT to prime polyadenylated RNA transcripts . . ."); CX-0004C (Butte DWS) at Q/A 263. The barcode molecules comprise identical barcode sequences that are distinct from the barcode

sequences of the barcode molecules attached to any other gel bead. *Id.* The barcode molecules are releasably attached to the gel beads through a [REDACTED] that can be broken through the application of [REDACTED]. CX-0477.00002 (“Gel beads dissolve and release their oligonucleotides for reverse transcription of polyadenylated RNAs.”); CX-0004C (Butte DWS) at Q/A 266.

Based on the foregoing, I find that the single-cell domestic industry products satisfy the first step of claim 1.

c. Step 2: “generating a plurality of droplets”

As required by the second step of claim 1, the domestic industry products generate a plurality of droplets, wherein at least 1,000 of the droplets comprise a “single gel bead” and a “single cell.” *See, e.g.*, CX-0477.00001 (“Within each microfluidic channel, ~100,000 GEMs are formed per ~6-min run, encapsulating thousands of cells in GEMs.”), .00002 (“The core of the technology is a Gel bead in EMulsion (GEM). GEM generation takes place in an 8-channel microfluidic chip that encapsulates single gel beads at ~80% fill rate”); CX-0004C (Butte DWS) at Q/A 566.

Bio-Rad argues that the domestic industry products do not satisfy the second step of claim 1 because the products do not “generate a collection of ‘at least 1,000 droplets’ each having a ‘single gel bead’ and ‘single cell.’” RIB at 198. This is the same argument that Bio-Rad made with respect to the accused products: Because the cells start to lyse almost immediately after droplet formation, at any instant of time there are less than 1,000 droplets with a cell and gel bead. *Id.* As discussed above in the context of infringement, claim 1 only requires the generation of at least 1,000 droplets containing a cell and gel bead before the third step, not that a “collection” of such droplets exist before the start of the third step.

Based on the foregoing, I find that the accused products satisfy the second step of claim

1.

d. Step 3: generating a plurality of “barcoded polynucleotide molecules”

The domestic industry products perform the third step of claim 1 when the droplets are heated on the thermal cycler. After the droplets are generated, they are transferred to a thermal cycler and heated at 53°C for 45 minutes and then heated at 85°C for 5 minutes. CX-0481.00013. While the droplets are being heated on the thermal cycler, the barcode molecules are released from the gel bead through the application of [REDACTED], which dissolves [REDACTED] [REDACTED] holding the barcode molecules to the gel beads. CX-0481.00011; CX-0004C (Butte DWS) at Q/A 481. In each of at least 1,000 droplets, two or more barcoded polynucleotide molecules are generated using the mRNA from the cell and the barcode molecules from the bead. CX-0481.00011 (“Incubation of the GEMs then produces barcoded, full-length cDNA from poly-adenylated mRNA.”); CX-0004C (Butte DWS) at Q/A 576-78.

Bio-Rad argues that 10X has “not provided any evidence showing that a plurality of barcoded polynucleotides are formed in each droplet on 10X’s thermocycler.” RIB at 199. Bio-Rad’s argument is the same as the one it made with respect to accused products: Because cell lysis begins as soon as the droplets are formed, the generation of barcoded polynucleotides begins before the droplets are incubated. This argument fails for the same reasons that it failed in the context of infringement.

According to 10X documents, barcoded polynucleotides are generated when the droplets are being heated on the thermal cycler. CX-0481.00011 (“Incubation of the GEMs then produces barcoded, full-length cDNA from poly-adenylated mRNA.”); *see also* CX-0004C (Butte DWS) at Q/A 576-78. To counter this evidence, Bio-Rad points to the testimony of its

expert Dr. Metzker, who testifies that the generation of barcoded mRNA starts in each droplet almost as soon as the droplet is formed. RX-0665C (Metzker RWS) at Q/A 117. Dr. Metzker, however, does not testify that barcoding is completed in any or all of the droplets before they are incubated. Even if barcoded polynucleotides start to form immediately after the droplet is formed, there is no evidence that the generation of barcoded polynucleotides would be completed in any of the droplets before they are transferred to the thermal cycler.

The droplets in the domestic industry product are heated at temperatures and durations similar to those used in the accused products to stimulate the release of the barcode molecules from the gel beads and the generation of the barcoded molecules. In the domestic industry products, droplets are generated at room temperature (~20°C) in 6.5 minutes. CX-0481.00013 (“GEM Generation – 6.5 minutes”), .00018 (“Equilibrate to room temperature before use”). In the ddSEQ v1 products, the droplets are generated at room temperature in five minutes. JX-0034.00005. In the domestic industry products, the droplets are heated on the thermal cycler at 53°C for 45 minutes and then at 85°C for 5 minutes. CX-0481.00026. In the ddSEQ v1 products, the droplets are heated on the thermal cycler at 37°C for 30 minutes and then at 50°C for 60 minutes. JX0034.00026. Similar to 10X’s documentation for the domestic industry products, Bio-Rad’s documentation describes barcoded cDNA being generated through reverse transcription while the droplets are being heated on the thermal cycler. *See, e.g.*, JX-0088C.00015; JX-0034.00043; JX-0034C.00025, .00026.

Based on the foregoing, I find that the domestic industry products practice claim 1.

2. Claims 4, 11, 14, 19, 26, and 28

Claim 4, 11, 14, 19, 26, and 28 depend either directly or indirectly from claim 1. There is no dispute that the single-cell domestic industry products satisfy the additional limitations of these dependent claims.

a. Claim 4

The cells provided by the domestic industry products have mRNA. CX-0004C (Butte DWS) at Q/A 260, 570; CX-0481.00015; CX-0477.00004. As further required by claim 4, barcoded polynucleotides are generated by reverse transcribing the mRNA in the presence of the barcode molecules. CX-0481.00011; CX-0004C (Butte DWS) at Q/A 576-78. Accordingly, I find that the domestic industry products practice claim 4.

b. Claim 11

As required by claim 11, in each droplet, the barcode molecules are released from the gel bead. CX-0481.00011; CX-0004C (Butte DWS) at Q/A 481. Accordingly, I find that the domestic industry products practice claim 11.

c. Claim 14

In accordance with claim 14, there at least 1,000 barcode molecules “disposed within” each gel bead. Specifically, the beads are porous polyacrylamide gel beads. CX-0004C (Butte DWS) at Q/A 587. Each gel bead has over 1,000 barcode molecules disposed throughout its entire volume. *Id.*; CX-0479C.00010; CX-0542.00001 (“Each Gel Bead contains millions of oligo primers . . .”). Accordingly, I find that the domestic industry products practice claim 14.

d. Claim 19

The barcode molecules of the domestic industry products include combinatorial assemblies of sequences formed from sequence modules. CX-0004C (Butte DWS) at Q/A 589; CX-0425C.00016; JX-0037C.00036-.00042. As required by claim 19, each of the combinatorial

assemblies has a first sequence [REDACTED] a second sequence [REDACTED] and a third sequence [REDACTED]. *Id.* Accordingly, I find that the domestic industry products practice claim 19.

e. Claim 26

As required by claim 26, the gel beads have at least 1,000,000 barcode molecules. CX-0481.00061 (“Gel Beads are the foundation of 10x Genomics® technology, and are beads functionalized with millions of copies of a 10x Barcoded primer.”); CX-0004C (Butte DWS) at Q/A 263, 592. Accordingly, I find that the domestic industry products practice claim 26.

f. Claim 28

As required by claim 28, the barcode molecules of the domestic industry products become detached from the gel beads before the barcoded polynucleotide molecules are generated. CX-0004C (Butte DWS) at Q/A 275, 594; CX-0542.00001 (“Once partitioned, the Gel Bead dissolves and its oligo primers are released into the aqueous environment of the GEM. The cell captured in the GEM is also lysed. The contents of the GEM (oligos, lysed cell components and Master Mix) are incubated in an RT reaction to generate full-length, barcoded cDNA from the poly A-tailed mRNA transcripts.”). Accordingly, I find that the domestic industry products practice claim 28.

E. Invalidity

Bio-Rad contends that the asserted claims of the ’530 patent are invalid as anticipated or rendered obvious by the ’059 patent and/or the Church patent, alone or in combination with additional prior art. RIB at 199-215. All of the recited claims require barcode molecules that are “releasably attached” to a gel bead, and the parties’ arguments regarding invalidity for the ’530 patent are substantially identical to those addressed above in the context of the “releasable

attachment” limitation of the ’024 patent. *See* SRB at 107. For the same reasons discussed above, Bio-Rad has failed to show that any asserted claim of the ’530 patent is anticipated and/or rendered obvious by the ’059 patent and/or the Church patent because these references do not disclose the “releasably attached” limitation.¹⁹ In addition, the success of 10X’s domestic industry products further weigh against a finding of obviousness.

VIII. ADDITIONAL DEFENSES

A. Inventorship

1. Pertinent Factual Background

In 2008, Dr. Benjamin Hindson and others founded QuantaLife to develop a droplet digital PCR system. Tr. (Hindson) 137:20-22; CX-0001C (Hindson WS) at Q/A 22-25. Dr. Hindson was Chief Scientific Officer. Tr. (Hindson) at 137:23-25; CX-0001C (Hindson WS) at Q/A 25. Dr. Nicholas Heredia joined QuantaLife in May 2009 as a Senior Molecular Biologist. RX-504C (Heredia WS) at Q/A 8. Dr. Serge Saxonov joined QuantaLife in 2010. Tr. (Saxonov) at 771:13-15. Dr. Saxonov was Vice President of Application Development for QuantaLife’s droplet digital PCR system. *Id.* at 771:16-21.

In 2011, Bio-Rad purchased QuantaLife. CX-0001C (Hindson WS) at Q/A 31. Drs. Hindson, Saxonov, and Heredia became Bio-Rad employees. Tr. (Saxonov) at 771:9-12); CX-

¹⁹ 10X further contends that the ’059 patent and the Church patent fail to disclose the step of “generating” droplets, CIB at 241-42, arguing for a distinction between the term “merging” and the term “generating,” which is supported by Dr. Dear’s citation to deposition testimony from Dr. Agresti. *See* CX-1827C (Dear RWS) at Q/A 604-09, 719-22. 10X cites no evidence from the intrinsic record that the claim language of the ’530 patent makes a distinction between “merging” and “generating” droplets, however. The ’059 patent includes several paragraphs under the heading “Droplet Generation,” which includes discussions of emulsions and the coalescence of smaller droplets with larger droplets. JX-0031, col. 13:5-37. In addition, Dr. Metzker has identified specific disclosures in the ’059 patent and in Church that meet this limitation. RX-0664C at Q/A 349, 382.

0001C (Hindson WS) at Q/A 33; RX-0504C (Heredia WS) at Q/A 6. Dr. Hindson's role at Bio-Rad [REDACTED]

[REDACTED] CX-0001C (Hindson WS) at Q/A34. In April 2012, Drs. Hindson and Saxonov resigned their positions at Bio-Rad on the same day. Tr. (Hindson) at 163:6-14. Dr. Heredia remained at Bio-Rad, where he still works. RX-0504C (Heredia WS) at Q/A 3, 6. Three months later, after taking a break from work, Drs. Hindson and Saxonov founded 10X. Tr. (Hindson) at 163:22-24; CX-0001C (Hindson WS) at Q/A 38-40. The first provisional patent applications for the asserted patents were filed in August 2012. *See, e.g.*, JX-0003 ('024 patent, cover), JX-0005 ('468 patent, cover).

Bio-Rad and Dr. Heredia claim that Dr. Heredia was improperly omitted as a co-inventor on the asserted patents, and that the patents are therefore invalid. *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1349 (Fed. Cir. 1998) (“[I]f nonjoinder of an actual inventor is proved by clear and convincing evidence . . . a patent is rendered invalid.”). Bio-Rad contends that Drs. Hindson and Saxonov, while they were at QuantaLife, “built off of” the “fundamental solution that Hindson and Heredia had come up with [REDACTED].” Tr. (Opening Statement) at 95:8-10. 10X counters that the technology described in the asserted patents is distinct from anything that was described by Dr. Heredia or worked on by him or any others at QuantaLife.

2. Alleged inventorship

Dr. Heredia claims to be an inventor on all four of the patents in suit. RX-0504C (Heredia WS) at Q/A 20 [REDACTED]

[REDACTED]

[REDACTED]

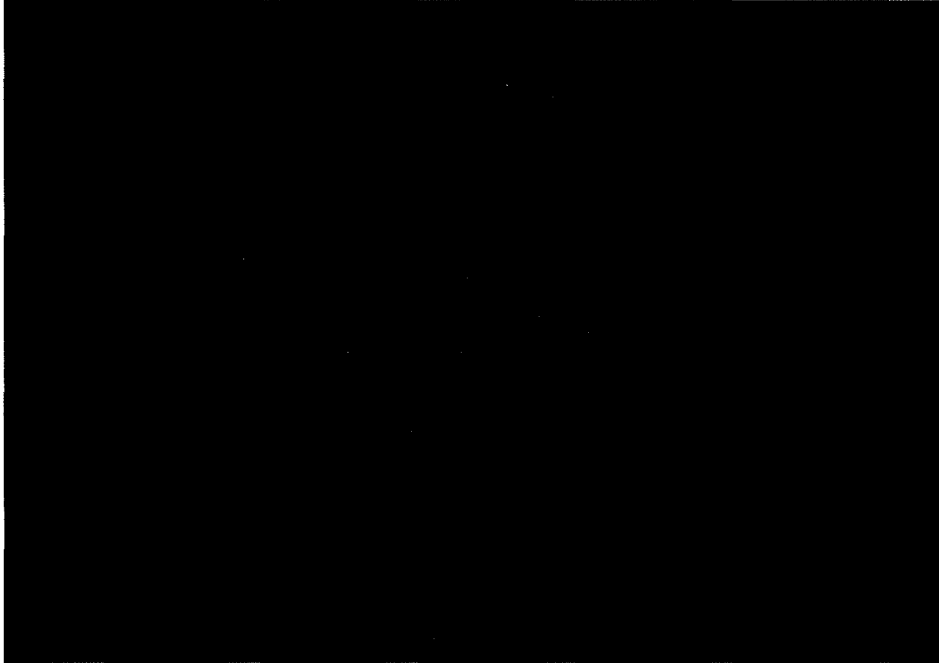
[REDACTED]

[REDACTED]

In terms of his claim of co-inventorship, however, he points only to his work with Dr. Hindson. *Id.* at Q/A 11. Dr. Heredia alludes to [REDACTED]

[REDACTED]

[REDACTED]



JX-0057C.00018 .

[REDACTED]

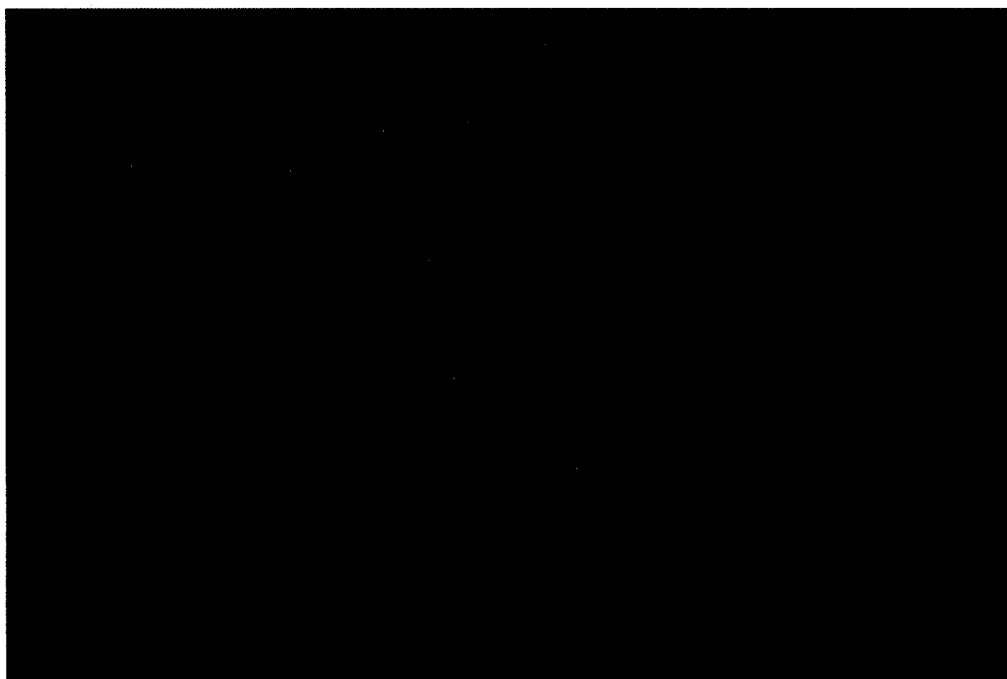
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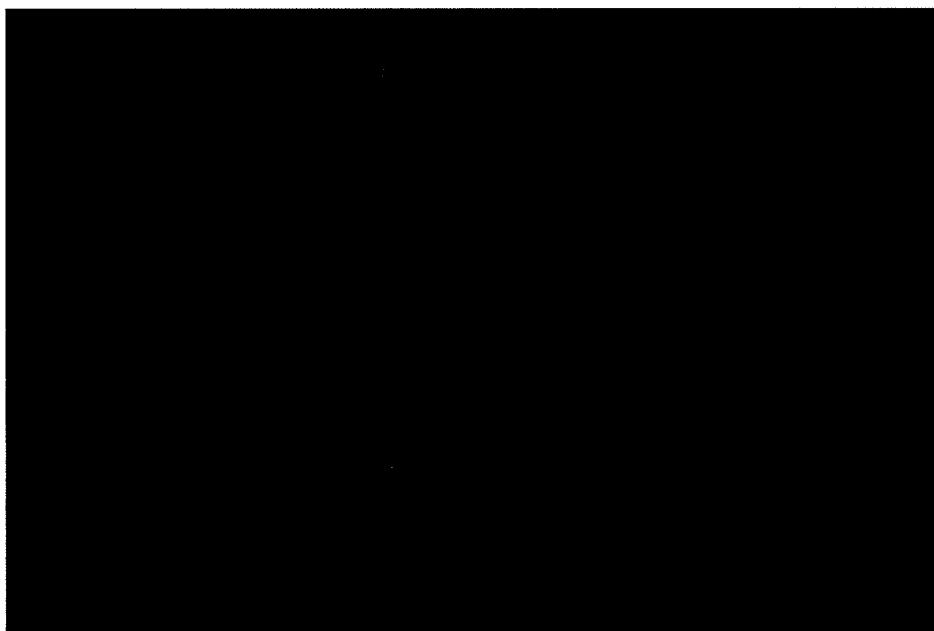
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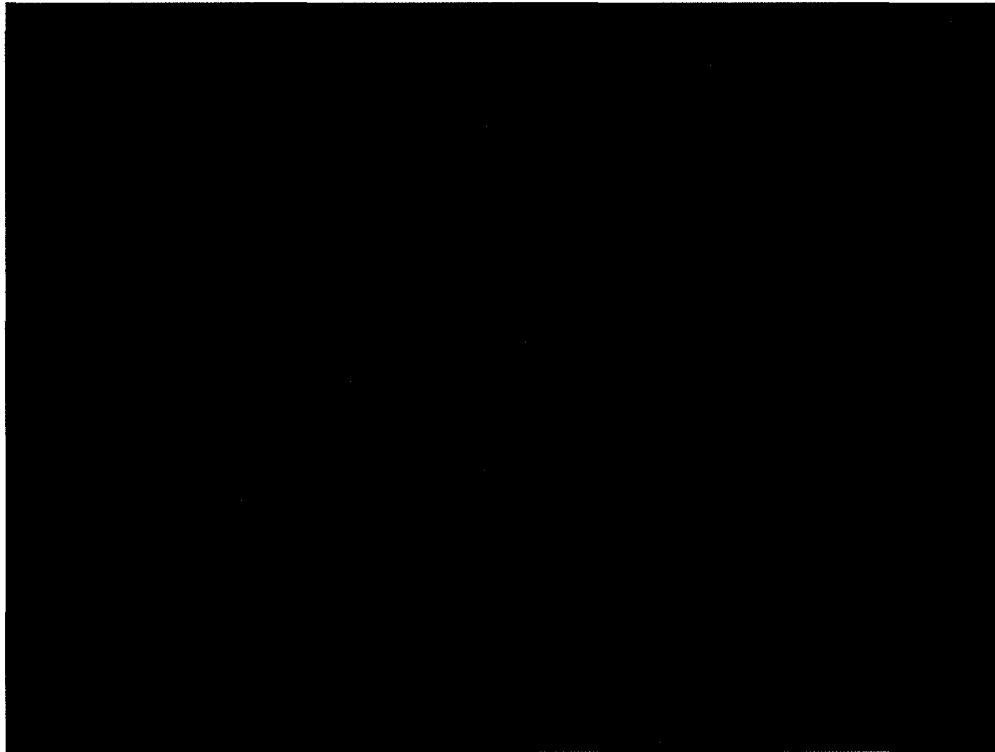
20 [REDACTED]



JX-0120C.00007;



JX-120C.00008; and



JX-0120C.00009

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3. Discussion

a. Legal Standards

The statutory requirements regarding joint inventorship state, in pertinent part:

When an invention is made by two or more persons jointly, they shall apply for patent jointly and each make the required oath, except as otherwise provided in this title. Inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent.

35 U.S.C. § 116 (a).

A joint invention is “the product of collaboration,” and requires that “each of the inventors work on the same subject matter and make some contribution to the inventive thought and to the final result.” *Vanderbilt Univ. v. ICOS Corp.*, 601 F.3d 1297, 1302 (Fed. Cir. 2010) (quoting *Monsanto Co. v. Kamp*, 269 F. Supp. 818, 824 (D.D.C. 1967)) (internal quotation marks omitted). “[T]he critical question for joint conception is who conceived, as that term is used in the patent law, the subject matter of the claims at issue.” *Ethicon, Inc. v. U.S. Surgical Corp.*, 135 F.3d 1456, 1460 (Fed. Cir. 1998). “Conception is the touchstone of inventorship” and “[i]t is ‘the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.’” *Burroughs Wellcome Co. v.*

²¹ In several instances, Dr. Heredia’s testimony at hearing had evolved significantly from the testimony he gave at his deposition. For example, with respect to the issue discussed above, whether

CX-0014C at 211:14-21. This was the pattern of Dr. Heredia’s testimony throughout the hearing. See *infra*. His credibility suffers as a result.

Barr Labs. Inc., 40 F.3d 1223, 1227-28 (Fed. Cir. 1994) (quoting *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986)).

“It is not necessary that the entire invention concept should occur to each of the joint inventors” *Vanderbilt*, 601 F.3d at 1302 (quoting *Monsanto*, 269 F. Supp. at 824). “[E]ach contributor need not have their own contemporaneous picture of the final claimed invention in order to qualify as joint inventors.” *Id.* at 1303 (citing *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997)). However, “[o]ne who simply provides the inventor with well-known principles or explains the state of the art without ever having a firm and definite idea of the claimed combination as a whole does not qualify as a joint inventor.” *Nartron Corp. v. Schukra U.S.A. Inc.*, 558 F.3d 1352, 1356 (Fed. Cir. 2009) (quoting *Ethicon*, 135 F.3d at 1460). “[T]he qualitative contribution of each collaborator is the key—each inventor must contribute to the joint arrival at a definite and permanent idea of the invention as it will be used in practice.” *Vanderbilt*, 601 F.3d at 1303 (quoting *Burroughs*, 40 F.3d at 1229).

In general, “[t]he inventors as named in an issued patent are presumed to be correct.” *Nartron*, 558 F.3d at 1356 (quoting *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997)). Proof of joint inventorship requires clear and convincing evidence. *Vanderbilt*, 601 F.3d at 1305.

b. Insufficient evidence of collaboration

“A primary focus of section 116 has [] always been on collaboration and joint behavior.” *Vanderbilt*, 601 F.3d at 1303. “The interplay between conception and collaboration requires that each co-inventor engage with the other co-inventors to contribute to a joint conception.” *Id.*

Dr. Hindson testifies that he did not collaborate with Dr. Heredia on the [REDACTED]. He explains that Dr. Heredia was a new employee at QuantaLife in May 2009 and that his role

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was limited to “assisting in validation and testing.” CX-1828C (Hindson RWS) at Q/A 6; *see* Tr. at 181:19-23 [REDACTED]

[REDACTED] He recalls discussing Dr. Heredia’s [REDACTED] for five or 10 minutes, but he states that [REDACTED] CX-1828C (Hindson RWS) at Q/A 11; Tr. at 181:24-182:16. Dr. Hindson says he commented to Dr. Heredia that he had done well to put his idea down on paper only because he did not want to discourage him. CX-1828C at Q/A 11. Dr. Hindson testifies that he did not know of any follow-up work on Dr. Heredia’s [REDACTED], that no research plan was developed based on the idea, that no experiments were conducted, and that the idea did not inform any work Dr. Hindson performed at QuantaLife or Bio-Rad. *Id.* at Q/A 21-22.

Dr. Heredia does not specifically dispute Dr. Hindson’s recollection that there was no significant collaboration between him and Dr. Hindson based on the [REDACTED]. *See, e.g.*, CX-0015C (Heredia Dep.) at 335:21-336:2 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]). He maintains, however, that [REDACTED] show “an inventive contribution,” Tr. (Heredia) at 602:7-13, and collaboration, and that [REDACTED]

[REDACTED], JX-0120C, shows follow-up. RX-0504C at Q/A 16 [REDACTED]

[REDACTED]

[REDACTED] He recalls no subsequent development or any additional conversations with Dr. Hindson or others at QuantaLife concerning [REDACTED], however. *E.g.*, Tr. (Heredia) at 584:15-19 (“... I can’t recall But I have a vague sense that Dr. Hindson talked about, you know, [REDACTED]

594:12-18 ([REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]. Dr. Heredia also testifies that he recalls no
conversations with Dr. Saxonov about the [REDACTED]. *Id.* at 594:7-11.

In sum, apart from Dr. Heredia's somewhat vague and uncertain testimony, his [REDACTED]
[REDACTED], which do not clearly demonstrate a collaborative
effort to develop Dr. Heredia's idea, Bio-Rad points to no evidence to show that Dr. Heredia
collaborated with other scientists at QuantaLife or Bio-Rad on any project concerning the [REDACTED]
[REDACTED]. Dr. Hindson denies that such a collaboration occurred, and Dr. Heredia cannot recall any
specific collaborative activities concerning development of his [REDACTED], beyond the
alleged brainstorming discussion with Dr. Hindson, the details of which are disputed by Dr.
Hindson. On this record, I find insufficient evidence to establish that Dr. Heredia collaborated
with others to develop the technology in the asserted patents.

c. Insufficient evidence of conception

The "core idea" of the "gel bead-in-emulsion" or "GEM" architecture claimed in the
asserted patents

is about partitioning nucleic acids, DNA or RNA, in droplets together with gel
beads that are used to deliver the barcodes into the droplet. The gel beads contain
oligonucleotide barcodes. In each gel bead there are a large number of
oligonucleotide molecules that include barcode sequences . . . Those
oligonucleotide barcodes are released from the gel beads using a stimulus. They
attach to the nucleic acids in the droplet. An amplification reaction is used to
create barcoded nucleic acids, and those can be used for downstream processing.

CX-0003C (Schnall-Levin WS) at Q/A 27 (discussing the '024 patent).

Dr. Heredia's [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] *Id.* at .00004.

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] *Id.* at .00005.

Bio-Rad's argument is that Dr. Heredia's [REDACTED]
[REDACTED] address the same problem of "sample preparation for analysis of biological materials such as nucleic acids," that ultimately is addressed in the asserted patents. Tr. at 86: 22-23. Bio-Rad maintains that Dr. Heredia's solution to the problem can be reduced to four parts that track the invention described in the asserted patents: First, Bio Rad identifies "partitioning the sample into droplets." *Id.* at 86:25-87:1. Second is "creating a reagent delivery system." *Id.* at 87:1-2. Third is "combining the sample and reagent delivery system with droplets using microfluidics." *Id.* at 87:2-3. Fourth is tracking "the sample reagent reaction

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complex with a barcode mechanism.” *Id.* at 87:4-5. Bio-Rad’s counsel use this construct to maintain that all of the elements ultimately found in the patents-in-issue were conceptualized by Dr. Heredia in 2009.

The evidence fails to persuade clearly and convincingly that Dr. Heredia in 2009 had in mind anything like the architecture of the GEM, however, as described by Dr. Schnall-Levin, above. This is true for several reasons.

Fundamentally, nothing in Dr. Heredia’s materials indicates how his idea would work. Dr. Heredia’s [REDACTED] does not explain even on a basic level how his [REDACTED] functions. CX-1827C (Dear RWS) at Q/A 1145 (“The description in [REDACTED] is a bare sketch of at best a partially formed idea that does not show any way to deal with even the basic issues that would confront someone trying to make such a thing work.”); *see* CX-1828C (Hindson RWS) at Q/A 16-19. One who “merely suggests an idea of a result to be accomplished, rather than means of accomplishing it, is not a joint inventor.” *Nartron*, 558 F.3d at 1359 (quoting *Garrett Corp. v. United States*, 422 F.2d 874, 881 (1970)).

More specifically, Bio-Rad’s efforts, through Dr. Metzker, to isolate various aspects of the patented technology to claim that they were conceived by Dr. Heredia in 2009 fail due to lack of evidentiary support. For example, Dr. Metzker indicates that Dr. Heredia’s inventive contribution was “a reagent delivery system.” Tr. (Metzker) at 717:5-22; 716:19-21 (“thinking about it as a reagent delivery system within an aqueous droplet”). Dr. Heredia, however, appears to have had no idea of the reagent delivery system described in the asserted patents. Tr. (Heredia) at 589:6-11 ([REDACTED]

[REDACTED]);

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Tr. (Heredia) at 590:9-22 ([REDACTED]).

Bio-Rad seeks to draw an equivalence between the [REDACTED] described by Dr. Heredia and the porous gel bead described in the asserted patents and used in 10X's GEM technology. The effort fails. First, Dr. Metzker concedes that Dr. Heredia's idea entailed the use of a [REDACTED] that was "already in the art." Tr. at 718:7-8. He testifies that Dr. Heredia's [REDACTED] are [REDACTED] Tr. at 712:19-21. Luminex beads were "extremely well understood at the time of Dr. Heredia's lab notebook entry," Dr. Metzker says. Tr. 716:3-5. Dr. Metzker concedes that "the idea of a capsule in a droplet that can release its contents into the droplet also "might very well be" something known in the state of the art at the time. Tr. at 722:22-723:12. Putting an analyte within an aqueous droplet was "certainly known state of the art by 2009," Dr. Metzker testifies. *Id.* at 724:12-22. The case law is clear that merely describing prior art is not an inventive idea. *Nartron*, 558 F.3d at 1356.

In addition, Dr. Heredia's idea of a [REDACTED] does not encompass the functionality of a gel bead. Dr. Metzker opines that Dr. Heredia's [REDACTED] [REDACTED] [REDACTED] RX-0664C (Metzker DWS at Q/A 480). These assertions are unconvincing. As explained by 10X's expert, Dr. Dear, Dr. Heredia's [REDACTED] [REDACTED] which is not the same as a bead, a distinction that would have been understood in the art at the time. CX-1827C (Dear RWS) at Q/A 1148. [REDACTED] [REDACTED] *Id.* at Q/A 1149. *See* Tr. (Hindson) at

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172:6-7 (describing Luminex as “a capture bead, a solid bead that’s used to capture analytes from solution for subsequent detection”); *see also* CX-1828C (Hindson RWS) at Q/A 10.

Dr. Heredia not only did not describe the functionality of the patented gel beads in his 2009 materials, he did not conceive of that functionality. As noted by Dr. Dear, Dr. Heredia at deposition and at trial “struggled to articulate an understanding of what the relationship between [REDACTED] and any of the claimed inventions was.” *Id.* at Q/A 1172. In fact, Dr. Heredia apparently struggled at his deposition to understand what a porous gel bead (as disclosed in the asserted patents), actually is. *See, e.g.*, CX-0014C (Heredia Dep.) at 42:2-11 (“Q. [] Are porous gel beads and [REDACTED] the same thing? A. Well, gels are just an extremely viscous liquid, in my understanding. So they’re very related.”). Dr. Metzker, Bio-Rad’s expert, implicitly contradicts Dr. Heredia’s testimony, agreeing that “a gel is not a viscous liquid,” *id.* at 713:5, and rejects the notion that Dr. Heredia’s [REDACTED] is a gel. Tr. (Metzker) at 712:23-25, 713:5-8. Although Dr. Metzker testifies that Dr. Heredia’s [REDACTED] [REDACTED] Tr. at 712:14-22, he admits that nothing in Dr. Heredia’s depiction of his [REDACTED] indicates that it was either porous or a gel. Tr. 714:10-2. Dr. Heredia himself cannot say whether in 2009 he knew what a porous gel bead was. Tr. 581:18-22.

Dr. Metzker opines that “Dr. Heredia specifically conceived and contributed [REDACTED] [REDACTED] [REDACTED] RX-0664C (Metzker DWS) at Q/A 480. Dr. Metzker opines that Dr. Heredia’s idea as set forth in [REDACTED] [REDACTED]

[REDACTED] *Id.* Dr. Metzker says Dr. Heredia’s idea [REDACTED]

[REDACTED] *Id.* at 481. Dr. Heredia's materials, however, depict no mechanism for achieving this result. As noted above, Dr. Heredia himself testifies that he cannot recall having "the idea of applying a stimulus to a bead to release oligonucleotide molecules from it." Tr. (Heredia) at 590:9-22. Dr. Dear confirms that Dr. Heredia's [REDACTED] does not depict oligonucleotide barcodes or barcodes releasably attached to anything; it does not show any attachment that is releasable upon the application of a stimulus. CX-1827C (Dear RWS) at Q/A 1142. Dr. Heredia himself concedes that the oligonucleotides he envisioned were "not going to be released into the interior." CX-0014C (Heredia Dep.) at 172:21-173:4; *see also* Tr. at 589:6-11. Again, Dr. Metzker's efforts to extrapolate elements of the GEM architecture from Dr. Heredia's depictions of his liquid [REDACTED] are unpersuasive.

Even if one were to accept the proposition that Dr. Heredia's [REDACTED] could be considered a porous gel bead, Dr. Heredia's notebook does not disclose barcoding nucleic acids or any microfluidic system; it does not disclose a barcode that can function as a unique label; and it does not disclose what the numbers of droplets would be. CX-1827C (Dear RWS) at Q/A 1142. "In short," Dr. Dear testifies, "this [REDACTED] ntry does not come close to showing conception of any claim in any 10X Asserted Patent." *Id.* at Q/A 1146-1147. *See* CX-1828C (Hindson RWS) at Q/A 16-19.

Specifically with respect to the draft provisional application, Dr. Dear notes that Dr. Heredia discusses [REDACTED]
[REDACTED]
[REDACTED] as disclosed in the 10X inventions. CX-1827C (Dear RWS) at Q/A 1156. Dr. Dear notes further that [REDACTED]

[REDACTED]. *Id.* at Q/A 1158. Dr. Heredia's [REDACTED] does not depict how [REDACTED] in other words, Dr. Heredia's idea "would not work without something not actually depicted." *Id.* at Q/A 1165. In sum, Dr. Dear demonstrates persuasively that Dr. Heredia's 2009 idea lacks the elements which, combined, interact to effectuate the patented invention.

Bio-Rad argues that an inventor need only contribute one individual feature to an invention. But the evidence, as discussed, does not support the contention that Dr. Heredia contributed even one element. Dr. Heredia himself does not point to anything his idea for a liquid bead contributed to the invention patented by 10X. *See, e.g.*, Ex. CX-0014C (Heredia Dep.) at 114:10-12 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Bio-Rad lays great stress on case law that says each contributor need not have "their own contemporaneous picture" of the final claimed invention to qualify as a joint inventor. RIB at 13 (quoting *Vanderbilt*, 601 F.3d at 1302). Bio-Rad relies on case law holding that a contribution to individual features of a patented invention, "even at different times," may qualify for joint inventorship. *Id.* at 14. The evidence here does not establish clearly and convincingly that Dr. Heredia's work contributed to the patented technology at any time. Dr. Heredia did not conceive of anything at all that worked at the time he thought of it or that contributed to technology that was developed later. These facts distinguish this case from the cases Bio-Rad

cites in support of its arguments. “[O]ne who is ‘too far removed from the real-world realization of an invention’ is not a co-inventor.” *Nartron*, 558 F.3d at 1359 (quoting *Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1359 (Fed. Cir. 2004)).

Bio-Rad argues that Dr. Heredia’s disclosures share the “context” of the patented inventions. This is true only at a level of generality so high that it would render the concept of inventorship meaningless. As 10X asserts, “Dr. Heredia’s [REDACTED] was a goal with no operative means to achieve it.” CIB at 160. While Dr. Heredia’s idea may have related generally to sample preparation and the “same sample preparation context,” RRB at 61-62, he made no contribution toward meeting the goals of the invention in the way described in the patents. I cannot find clear and convincing evidence that Dr. Heredia’s conception contributed at all, much less in a qualitative way, to the invention claimed in the asserted patents.

d. Insufficient evidence of significance

“‘A joint inventor must contribute in some significant manner to the conception or reduction to practice of the invention [and] make a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention.’” *Nartron*, 558 F.3d at 1356-57 (quoting *Pannu*, 155 F.3d at 1351).

Even Dr. Metzker admits that Dr. Heredia’s idea “in isolation” is not a “significant contribution.” *Id.* at Tr. 726:3-9. Dr. Heredia’s idea, according to Dr. Metzker, is significant only if it [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Id. at 728:14-22. In this respect, 10X and Bio-Rad seem to agree. *See* Tr. (Schnall-Levin) at 230:15-24 (“[T]his invention is not like a bag

of words, like barcodes, gel beads. It's actually how they're all put together, which is really important for driving the performance of the system.""). Because there is no evidence that Dr. Heredia had an idea of how the elements that he allegedly conceived of would be put together to achieve the desired result, he made no significant contribution.

Absent evidence that Dr. Heredia's liquid bead contributed anything of significance to the patented technology (or any technology), Bio-Rad cannot demonstrate clearly and convincingly that Dr. Heredia is a joint inventor.

B. Ownership

As an affirmative defense to 10X's allegations of infringement, Bio-Rad claims ownership of each of the asserted patents in this investigation. 10X disputes Bio-Rad's claims of ownership, and Staff agrees with 10X. Although, in briefing the matter, the parties have lost their way in arguments concerning the law of inventorship, this is a contract dispute that boils down to a simple question: is there evidence that the idea embodied in the asserted patents was conceived by Drs. Hindson and Saxonov during the period in which they were employed by Quanta/Life and Bio-Rad? If the answer is yes, then as a matter of contract law, the asserted patents belong to Bio-Rad. If the answer is no, the asserted patents belong to 10X.

1. Legal Standards

"It is elementary that inventorship and ownership are separate issues." *Beech Aircraft Corp. v. EDO Corp.*, 990 F.3d 1237, 1248 (Fed. Cir. 1993). *Accord, Israel Bio-Eng'g Project v. Amgen, Inc.*, 475 F.3d 1256, 1263 (Fed. Cir. 2007) ("[I]ssues of patent ownership are distinct from questions of inventorship."). Ownership "is a question of who owns legal title to the subject matter in a patent," while "inventorship is a question of who actually invented the subject matter claimed in a patent." *Beech*, 990 F.2d at 1248. Bio-Rad confuses the issue by attempting

to use the legal analysis that applies to joint inventorship to resolve its ownership dispute with 10X. The distinction is illustrated in this case: the question whether Dr. Heredia should be treated as a co-inventor is one of inventorship; but there is no question that Drs. Hindson and Saxonov are inventors on the asserted patents. The question with respect to them is one of ownership, *i.e.*, do their contractual agreements with Bio-Rad and QuantaLife require that the asserted patents be assigned to Bio-Rad? *See FilmTec Corp. v. Hydranautics*, 982 F.2d 1546, 1550 (Fed. Cir. 1992) (stating that in a case that “turns on” “ownership”, the court only needs “to decide whether the invention . . . was made or conceived” during the period of employment).²²

Bio-Rad’s ownership claims arise solely as the result of the contract terms governing the employment of Drs. Hindson and Saxonov, who are among the named inventors of the asserted patents. In general, contract terms must be construed under state law. *Board of Trustees of Leland Stanford Junior Univ. v. Roche Molecular Sys., Inc.*, 583 F.3d 832, 841 (citing *Jim Arnold Corp. v. Hydrotech Sys.*, 109 F.3d 1567, 1572 (Fed. Cir. 1997)). The exception to this

²² Bio-Rad asserts that I adopted joint inventorship as a “guide” to ownership. RIB at 20 (citing Order No. 34). To the contrary, on reconsideration, Order. No. 41 clarified that “Order No. 34 did not conclusively establish the legal framework for deciding Bio-Rad’s ownership claim.” Order No. 41 at 2. In affirming denial of 10X’s motion for summary determination on the ownership issue, Order No. 41 recognized that the “legal standard for addressing the ownership issue” continued to be disputed, and that “the parties’ dispute would be better resolved after the conclusion of the evidentiary hearing, with the benefit of a complete evidentiary record regarding the contractual relationships between the parties and the contributions of the inventors.” *Id.* As stated in Order No. 41, doubt concerning the facts and the law precluded a ruling on summary determination, including on the applicable legal standards. *See also Gen’l Elec. Co. v. Wilkins*, No. CV F 10-0674 LJO JLT, 2012 WL 3778865(E.D. Cal. 2012) at *19 note 3 (“[T]his Court is not bound by its interlocutory orders, which are not final, and may reconsider or modify them at any time.”) (quoting *Marconi Wireless Telegraph Co. v. United States*, 320 U.S. 1, 63 (1943); *City of Los Angeles, Harbor Div. v. Santa Monica Baykeeper*, 254 F.3d 882(9th Cir. 2001)).

rule covers matters that are “intimately bound up with the question of standing in patent cases,” such as “whether contractual language effects a present assignment of patent rights, or an agreement to assign rights in the future.” *Id.* No such question is presented here.²³ This is important because the standard for determining joint ownership is a matter of patent law determined by federal courts, while the federal courts defer to state law on questions of contract. “[Q]uestions of contract law are matters of state law, questions related to patent law are interpreted according to federal law.” *General Elec. Co. v. Wilkins*, No. CV F 10-0674 LJO JLT, 2012 WL 3778865 (E.D.Cal. 2012).

Confusing the two issues leads to error, as described by the federal court in *STMicroelectronics, Inc. v. Harari*, Case No. C 05-4691 JF, 2006 WL 2032580 (N.D. Cal. 2006).²⁴ In that case, the court addressed a dispute similar to the facts here: a company sued its former employee alleging that certain inventions were subject to a contract in which the employee agreed to assign inventions made during the term of his employment. *Id.* at *1-2. The district court initially found federal jurisdiction based on a substantial question of federal patent law. *Id.* at *2. The court reversed its decision on reconsideration, holding that “[o]wnership and inventorship issues are completely separate issues,” and that the resolution of the ownership dispute depended entirely on the terms of the employment contract and the question of when “the

²³ Obviously, if Bio-Rad owns the patents, 10X lacks standing to assert them. But this is not a case in which there is a dispute concerning a present vs. a future assignment of rights, or how the actual assignment of patent rights among multiple parties affects standing. Interpretation of the contractual provisions, not application of the law of standing, determines the outcome in this instance.

²⁴ *Harari* is an unpublished decision. It is cited here not as precedent but as an instance in which a court mistakenly applied patent law inventorship principles to the issue of ownership, and thereafter recognized and corrected its mistake.

inventions described in the subject patents were ‘made or conceived.’” *Id.* at *10-11. This “presen[t]ed a factual question that does not implicate a substantial question of patent law,” the court ruled, sending the case back to state court. *Id.* at *12-14.

The *Harari* court explicitly rejected the idea that determining the “inventive contribution” made by the employee mattered at all in deciding whether the company owned the inventions made by him. “It is unclear,” the court lamented, “how Defendants, and subsequently the Court, came to inject the phrase ‘inventive contribution’ into the discussion of Harari’s contractual disclosure and assignment obligations. The phrase does not appear in the Inventions Agreement” *Id.* at *8. Because the employment agreements required disclosure and assignment of all inventions and rights to inventions made during the term of employment, “there was no need to inquire into Harari’s precise inventive contribution.” *Id.* at *11.

Harari relies on *AT&T v. Integrated Network Corp.*, 972 F.2d 1321 (Fed. Cir. 1992), a precedential Federal Circuit decision involving similar facts, in which the Federal Circuit reversed a district court decision asserting jurisdiction and remanded with instructions to send the case to a state court. *Id.* at 1325. In *AT&T*, four employees left AT&T to join another firm, INC, “as a team.” *Id.* at 1323. The employees were subject to agreements giving AT&T assignment rights in inventions made or conceived, either solely or jointly with others, during the course of their employment. *Id.*

The patent in question was filed about a year and a half later, naming the four former AT&T employees as inventors, and disclosing that the application for the patent was assigned to INC. *Id.* AT&T sued alleging that the invention in question had been disclosed in a proprietary [AT&T] memorandum prepared by one of the four employees during the period of employment. *Id.* AT&T alleged contract and tort claims. INC removed the case to federal district court, but

AT&T moved the district court to remand the case back to state court, arguing that it would seek to prove that the invention was conceived during the period of employment by AT&T, and that this did not present “a substantial question of federal patent law.” *Id. Accord, e.g., ReCor Med. Inc. v. Warnking*, C.A. No. 7387-VCN, 2013 Del. Ch. LEXIS 142 at *34 (Del. Ch. Ct. May 31, 2013) (“[T]he Court can see no reason why patent law should displace contract law here.” (citing *AT&T*)).

The district court kept the case but on appeal, the Federal Circuit held that it should be remanded to the state court for decision. *Id.* at 1324. The Circuit explained that “conception of inventions, as used in the employment agreement, is [not] solely a technical question of patent law.” *Id.* Specifically, the Circuit opined that the moment “when an invention was conceived may be more a question of common sense than of patent law.” *Id.* The Circuit said the state court was “free to look for guidance to the law on the conception of inventions as we may have explained it, but in light of the different facets of the word conceive, indeed of inventions, this may well not be determinative of the outcome” *Id.* at 1325 (quoting *Ingersoll-Rand Co. v. Ciavatta*, 542 A.2d 879 (1988). *Accord, e.g., Motorola, Inc. v. Lemko Corp.*, No. 08 C 5427, 2012 WL 74319, at *4-5 (N.D. Ill. Jan. 10, 2012) (“the parties did not necessarily use terms in their agreements in the same way in which they are defined in patent law”).

While the jurisdictional question addressed in *AT&T* does not arise in a case brought pursuant to section 337, the principle is the same: where an action sounding in contract is brought, the resolution of the contract dispute should be decided based on state law, even in a patent case.²⁵ A state court may look to federal law for “guidance” on questions of inventorship

²⁵ *Ingersoll-Rand* states that it is the employer’s burden to establish that conception occurred during the period of the employment contract. 542 A.2d at 894. *Accord, e.g., ReCor*, 2013 Del.

where that is appropriate, but an action for breach of contract remains a question of state law and does not arise under federal patent law. *AT&T, supra*. In the case before me, as in *AT&T*, the contract requires determination of when the idea that gave rise to the patents-in-issue was conceived. The time of conception, as the Circuit noted in *AT&T*, is not a patent law issue.

The parties in this case fall into the same trap bemoaned by the court in *Harari* to the extent that they argue about whether the concept of “complete inventorship” applies to Drs. Hindson and Saxonov. The notion of “complete inventorship” has no application with respect to ownership under the pertinent contracts. These contracts, like the contracts in *Harari*, are silent as to any inventive contribution, complete or incomplete, made by an employee. Under the unambiguous contract provisions, *see infra*, the only fact that matters is the actual time when the inventors conceived of the inventive idea embodied in the asserted patents. *See also Motorola*, 2012 WL 74319 at *5 (“[T]he terms ‘developed or conceived . . . during the term of my employment’ are not ambiguous. Their meaning is sufficiently clear that a jury could simply examine evidence of when the inventions or ideas embodied in the Lemko patents first came into existence in order to determine whether Pan and Labun’s actions were within the scope of the contractual term.”).

2. Discussion

The real dispute involves defining the inventive concept in the asserted patents. Bio-Rad has the burden to identify the idea of which it claims ownership. It has not done so. Instead, it has briefed the matter as if it owned a share of the patents because it could trace some elements of the asserted patents to work done at Quanta/Life and Bio-Rad. This is inconsistent with the

Ch. LEXIS 142 at *32 (employer “must show by a preponderance of the evidence that it is entitled to the relief it requested”).

contracts: [REDACTED]

[REDACTED] Bio-Rad, as 10X freely concedes, owns many ideas conceived by Drs. Hindson and Saxonov, but it does not own the idea for the specific arrangement of elements claimed in the asserted patents, as discussed herein, because there is insufficient evidence that that idea was conceived during the period of employment.

As described by Dr. Hindson, the invention claimed in the asserted patents is complex and consists of many elements. CX-0001C (Hindson WS) at Q/A 88. The inventive idea, which emerged from many other ideas (some of which clearly were in the prior art), is to combine these elements in a process resulting in what 10X calls the GEM (“gel bead in emulsion”) architecture. As confirmed by both parties, the inventive idea is a specific arrangement of elements which, when combined, works to achieve a desired goal. *See* Tr. (Metzker) at 728:14-22 (“[I]t has to work within the architecture of a droplet, so partitioning the analyte from other analytes, having a reagent delivery system that adds the reagents that we can then combine, barcode, analyze and then track back to the different droplets, to what is the makeup of that analyte. All of that, all of that together is important.”). *See also* Tr. (Schnall-Levin) at 230:15-24 (“[T]his invention is not like a bag of words, like barcodes, gel beads. It’s actually how they’re all put together, which is really important for driving the performance of the system.”). The asserted patents each claim particular steps in the GEM architecture, and for purposes of ownership, the employment contracts at issue require determination of who conceived of this architecture and when. *See ReCor*, 2013 Del. Ch. Ct. LEXIS at *29, 42 (examining the record to determine when the “aha” or “eureka” moment occurred). Bio-Rad does not address squarely the critical contractual question of when the inventive concept in the asserted patents was conceived. Instead, Bio-Rad clouds the real issue with misplaced arguments about inventive contributions.

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Consistent with the Federal Circuit's holding in *AT&T*, California law governs the pertinent employment agreements between Bio-Rad and Drs. Hindson and Saxonov. RX-0624C at ¶ 11; RX-0623C at ¶ 11; RX-0619C at ¶ 11; RX-0620C at ¶ 11. "Under California law, the interpretation of a written contract is a matter of law for the court even though questions of fact are involved." *Southland Corp. v. Emerald Oil Co.*, 789 F.2d 1441, 1443 (9th Cir.1986). Contract language that is plain and unambiguous requires no construction. "In interpreting an unambiguous contractual provision we are bound to give effect to the plain and ordinary meaning of the language used by the parties." *Lockyer v. R.J. Reynolds Tobacco Co.*, 107 Cal. App. 4th 516, 517 (2003) (quoting *Coast Plaza Doctors Hospital v. Blue Cross of California*, 83 Cal. App. 4th 677, 684 (2000)). Where "contract language is clear and explicit and does not lead to absurd results, we ascertain intent from the written terms and go no further." *Shaw v. Regents of Univ. of California*, 58 Cal. App. 4th 44, 53, 67 (1997). See Cal. Civ. Code § 1639 ("When a contract is reduced to writing, the intention of the parties is to be ascertained from the writing alone, if possible.").

The contracts in this case state, in pertinent part, with respect to QuantaLife:

[REDACTED]

[REDACTED]

[REDACTED]

And with respect to Bio-Rad:

[REDACTED]

[REDACTED]

RX-0619C at ¶¶ 3, 6; RX-0620C at ¶¶ 3, 6.

As set forth above, the QuantaLife contracts [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] RX-0623C at ¶2(a). The Bio-Rad contracts [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] RX-0619C at ¶¶3, 6. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] *Id.* at ¶3.

No provision of any of the applicable contracts governs future inventions that are based on or developed from work done during employment. To the contrary, the plain, unambiguous contract language pertains only to ideas actually conceived during the employment period. Bio-

Rad's arguments improperly read out the plain meaning of the durational limitation in the pertinent contracts, and in its place suggest an interpretation of the contracts in which inventions developed by the employee after his employment belong to the company if they are related to ideas conceived during employment. "When a dispute arises over the meaning of contract language, the first question to be decided is whether the language is 'reasonably susceptible' to the interpretation urged by the party. If it is not, the case is over." *Lockyer*, 107 Cal. App. 4th at 524. Bio-Rad's (implicit) construction is not reasonable.²⁶

Bio-Rad's contention that "[b]ecause Hindson and Saxonov made contributions to the inventions that are now claimed in the Asserted Patents [REDACTED] [REDACTED] . . . Bio-Rad has a pro rata undivided co-ownership interest in the Asserted Patents based on those contributions," RRB at 40, therefore is unavailing. Bio-Rad owns no interest in any of the patents unless it can demonstrate, in conformity with the contractual requirements, that Drs. Hindson and Saxonov actually conceived the inventive idea embodied in the asserted patents during the employment period. Bio-Rad does not cite to any provision of the employment contracts to support its contentions that an idea that is related to the invention embodied in the asserted patents, but is not the actual inventive idea in the asserted patents, confers ownership on Bio-Rad.

On review of this record, Bio-Rad has failed to present any direct evidence that the actual inventive idea embodied in the asserted patents was first conceived at Quanta/Life or Bio-Rad, as required by the contracts. Since it has presented no direct evidence of conception, Bio-Rad necessarily falls back on circumstantial evidence, asking me to infer that conception likely

²⁶ Bio-Rad has not actually offered any alternative construction of the contract terms.

occurred during the period of employment. Bio-Rad's argument is grounded mainly on the temporal proximity of Drs. Hindson and Saxonov's departure from Bio-Rad and the inventions developed thereafter by 10X.

These facts are basically undisputed: In October 2011, Bio-Rad acquired QuantaLife [REDACTED] RIB at 44 (citing RX-0502C (Tumolo DWS) at Q/A 32). Drs. Hindson and Saxonov worked at Bio-Rad for six months thereafter, leaving in what was a "coordinated event" in April 2012. *Id.* at 44-45 (citing Tr. (Hindson) at 162:3-9, 163:6-14; Tr. (Saxonov) at 797:4-21, 798:3-9). After taking off several months, Drs. Hindson and Saxonov formed 10X. Tr. (Hindson) at 163:3-164:3; CX-0001C (Hindson WS) at Q/A 38-40. Within four months of leaving Bio-Rad and less than a month after founding 10X, they filed their first provisional patent application at 10X on August 14, 2012, Provisional App. No. 61/683,192 (the "'192 application"). RX-0299.

This chronology alone does not establish circumstantially that the inventions at issue were conceived during Drs. Hindson and Saxonov's employment with QuantaLife and Bio-Rad. The circumstances of their departure make it likely that Drs. Hindson and Saxonov left Bio-Rad with the intention of pursuing opportunities to invent and market new technologies—they were free to do so. But these circumstances in themselves do not support a finding that Drs. Hindson and Saxonov conceived of the idea embodied in the asserted patents before they left Bio-Rad's employ.²⁷

²⁷ The record indicates that Drs. Hindson and Saxonov left Bio-Rad because [REDACTED]

[REDACTED] Tr. (Saxonov) at 798:14-24. [REDACTED]

Id. at 797:15-21.

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Bio-Rad challenges Dr. Hindson's credibility, asking me to infer that he is lying about the time frame in which the inventive idea in the asserted patents was conceived. Bio-Rad maintains that the '192 provisional application, submitted in August 2012, refers to gel beads, and that that disclosure is inconsistent with Dr. Hindson's testimony that conception of the claimed porous gel beads did not occur until the [REDACTED]. *Id.* at 45 (citing CX-0001C (Hindson WS) at Q/A 85). In context, however, Dr. Hindson's testimony that [REDACTED] is not inconsistent with the '192 provisional. Dr. Hindson recalls [REDACTED] CX-0001C (Hindson WS) at Q/A 86. "Around that time or shortly thereafter, [REDACTED] *Id.* Bio-Rad has not pointed to any portion of the '192 provisional patent application showing that the idea to use porous gel beads to deliver barcodes was conceived [REDACTED] before the events described in detail by Dr. Hindson.²⁸

Bio-Rad also points to a paper published in 2009 by inventors at Harvard, referred to as the "Beating Poisson" article. RIB at 47. The significance of the "Beating Poisson" article is that it discusses using microfluidics to deliver deformable gel beads to droplets that can be

²⁸ The '192 application states in pertinent part: "The microcapsules may also comprise a polymer within the interior of the capsule. In some instances this polymer may be a porous polymer bead that may entrap reagents or combinations of reagents. In other instances, this polymer may be a bead that has been previously swollen to create a gel." RX-0299 at ¶0050. This provision refers to a porous polymer bead that may entrap reagents but not to such a bead with barcodes or other reagents releasably attached, as in the asserted patents. As Staff notes, Bio-Rad's expert, Dr. Metzker, does not opine that the asserted claims were conceived in August 2012. SRB at 28 (citing Tr. (Metzker) at 705:2-22.)

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functionalized with DNA. *Id.* See RX-0102. Dr. Hindson testifies in his direct witness statement he came across the “Beating Poisson” paper only in late 2012, while at 10X. CX-0001C (Hindson WS) at Q/A 132. On cross-examination, he concedes that he had encountered the paper in April 2011, while still at QuantaLife, but he claims not to have read it at that time. Tr. at 169:5-22, 172:8-18.

Bio-Rad maintains that Dr. Hindson’s denial is implausible given the importance of the “Beating Poisson” article, pointing in particular to [REDACTED]

[REDACTED]
[REDACTED]
RIB at 48; Tr. (Hindson) at 169:18-171:23). Bio-Rad maintains that Dr. Hindson’s recollection also is undermined by [REDACTED]

[REDACTED] *Id.* (citing JX-0145C; Tr. (Saxonov) at 793:8-794:5.

I am not persuaded that this evidence undermines Dr. Hindson’s credibility. I find it at least plausible that Dr. Hindson did not remember seeing the “Beating Poisson” article or [REDACTED]. The record does not indicate that Dr. Hindson attached particular significance to the article at that time, or that [REDACTED] indicated the conception of the idea for the inventions claimed in the asserted patents.²⁹ If Dr. Hindson did

²⁹ [REDACTED]
[REDACTED] JX-0145C. [REDACTED] does not indicate that Drs. Hindson and Saxonov at that time conceived the idea asserted in the patents. On the contrary, it indicates that they had not conceived the idea embodied in the patents at that time, because there is no mention of using porous gel beads or releasably attached oligonucleotides. The record shows that Drs. Hindson and Saxonov [REDACTED]

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not realize in 2011 the significance of porous gel beads in the eventual development of the GEM architecture at 10X, it would be easy to forget [REDACTED]

[REDACTED] I conclude that Dr. Hindson's alleged lack of credibility is a slim reed for Bio-Rad to stand on.³⁰

In addition to challenging Dr. Hindson's credibility, Bio-Rad points to evidence that certain concepts disclosed in Drs. Hindson and Saxonov's earlier work prefigured the patented invention. Presumably, Bio-Rad would contend (if Bio-Rad were attempting to establish conception under the correct legal theory) that because certain discoveries made by Drs. Hindson and Saxonov during the period of their employment included elements that also are found in the asserted patents, the particular arrangement of those elements, set forth in the asserted patents, must have occurred to them. For example, Bio-Rad discusses the concepts [REDACTED]

[REDACTED]
[REDACTED] RIB at 40-44. Dr. Saxonov testifies, however, that [REDACTED]

[REDACTED] CX-1829C

[REDACTED]. If that in itself were sufficient to trigger ownership of inventions patented after they left Bio-Rad, the contracts' [REDACTED] would be nullities.

³⁰ I agree with Bio-Rad that Dr. Hindson on several occasions was not forthcoming in his representations to Bio-Rad's representative about the work that was being conducted at 10X, but Dr. Hindson testifies credibly that he felt threatened by Bio-Rad; people are known to react defensively when they perceive they are under attack, even when they have done nothing wrong. See CX-1828C (Hindson RWS) at Q/A 55 ("It was very clear to me based on our conversations what she was asking me was 'are you using Quantalife droplets,' essentially fishing for whether we were competing with our old Quantalife products, and the answer to that was clearly 'no,' because we were using GEMs.")

(Saxonov RWS) at Q/A 22 (“We had not thought through these issues or come up with solutions that would have made it work.”).

Bio-Rad also points out that certain number ranges of “cells, droplets, beads, and barcodes” were disclosed in the ’059 patent, JX-0031, and that the numbers discussed in the claims of the asserted patents, as Dr. Saxonov concedes, could be derived easily based on those ranges. RRB at 55 (quoting RX-0412C (Saxonov Dep. Tr.) at 148:15-149:12). These facts do not demonstrate, even circumstantially, that the idea for the inventions claimed in the asserted patents had already been conceived at the time the ’059 application was filed.³¹

Bio-Rad also contends that the entries in notebooks offered into evidence by 10X to support conception by the 10X inventors is “much more consistent with the theory that Dr. Hindson and others founded 10X to commercialize the ideas they had at QuantaLife and Bio-Rad.” RRB at 57. Bio-Rad cites testimony from Dr. Schnall-Levin and Dr. Dear that allegedly corroborates Bio-Rad’s argument that 10X’s lab notebooks do not evidence the conception of the inventions claimed in the asserted patents. RIB at 130-131. Even assuming Bio-Rad’s argument about the nature of 10X’s notebooks is correct (and this is disputed), it would not necessarily

³¹ 10X responds persuasively to each of the many circumstances alleged by Bio-Rad concerning the work done by Drs. Hindson and Saxonov during their period of employment, maintaining that their work was conducted in a variety of technological contexts distinct from the particular GEM architecture described in the asserted patents. *See* CIB at 139-151. It is not necessary or useful to try to resolve every one of the parties’ disputes. These disputes are largely beside the point because, as discussed above, they are not probative on the issue of when the particular arrangement that constitutes the inventive concept of the asserted patents actually was conceived by Drs. Hindson and Saxonov.

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lead to the conclusion that the claimed inventions were conceived at QuantaLife or Bio-Rad. Several months elapsed between the time Drs. Hindson and Saxonov left Bio-Rad and the founding of 10X. The actual idea could have been conceived at any time after Dr. Hindson and Saxonov left Bio-Rad's employ; the record does not indicate more likely than not that conception of the inventive idea in the asserted patents occurred before their departure.³²

In sum, the evidence before me is insufficient to permit the conclusion that, more likely than not, the work Drs. Hindson and Saxonov did at QuantaLife and Bio-Rad led them to conceive the idea described in the 10X patents while they were still under contract. *Compare Agilent Techs., Inc. v. Kirkland*, C.A. No. 3512-VCS, 2010 WL 610725 at *15 (Del. Ch. Ct. Feb. 18, 2010) (finding employees conceived of technology at issue "based upon insights they formed and recorded at Agilent from observing the empirical results of experiments they conducted at Agilent"). Bio-Rad presents no pertinent records showing insights or experiments that support the argument that the inventive idea in the asserted patents was conceived before these employees left Bio-Rad. Given that Bio-Rad bears the burden of proof on this issue, Bio-Rad has failed to establish ownership of the asserted patents. *See* CX-1827C (Dear RWS) at Q/A 1129 ("Nothing [Dr. Metzker] cites shows whether there was a partial experiment involving some but not all of these elements. Nothing shows how the experiments would work. Nothing he cites shows any experimental observation. Dr. Metzker does not rely upon anything in his

³² 10X's interrogatory responses detail with some specificity the timeline regarding development of the patented technology. *See* RX-0643C. In these responses, 10X seeks to show that the claims of the patents were conceived in [REDACTED]. *Id.* at 63-65. *See also* CX-1827C (Dear RWS) at Q/A 1269-1279. Dr. Metzker, Bio-Rad's witness, reviewed 10X's timeline regarding conception and declined to offer an opinion disagreeing with 10X's alleged [REDACTED] conception dates. Tr. (Metzker) at 704:7-705:22.

testimony offering a reasonable basis to conclude that any such experiments occurred nor, importantly, what happened in them.”).

C. Other Affirmative Defenses

Bio-Rad raises several additional affirmative defenses. None has any merit.

Bio-Rad’s equitable estoppel defense has two prongs. Bio-Rad contends that the employment agreements signed by Drs. Hindson and Saxonov [REDACTED]

[REDACTED]

[REDACTED] RIB at 132.

First, the agreements cited by Bio-Rad give no such “explicit contractual assurances.” Second, the evidence does not show that the inventions in the asserted 10X patents were made at QuantaLife and/or Bio-Rad.

Bio-Rad also contends that 10X is equitably estopped from bringing this action because Bio-Rad had no notice of infringement until this litigation was instituted, and Bio-Rad allegedly relied on 10X’s “silence and inaction” in developing its product line “with the reasonable belief that it would not be subject to an infringement action.” *Id.* at 133. Bio-Rad points to no evidence to support the contention that it relied on any lack of notice of infringement from 10X. *See id.* Bio-Rad’s equitable estoppel defense fails for lack of proof.

Bio-Rad also claims to have an express license to practice each of the asserted patents, based on Drs. Hindson and Saxonov’s [REDACTED]

[REDACTED] *Id.* at 133. Since Bio-Rad has not shown that the invention embodied in the 10X patents was made during the course of the employment agreement, this defense also fails.

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Bio-Rad claims an implied license, waiver, and acquiescence based on “‘circumstances [that] plainly indicate that the grant of a license should be inferred.’” *Id.* (quoting *Bandag, Inc. v. Al Bolser’s Tire Stores, Inc.*, 750 F.2d 903, 925 (Fed. Cir. 1984)). This defense is based on the same contractual provisions asserted by Bio-Rad “with respect to Bio-Rad’s affirmative defenses of acquiescence and equitable estoppel,” and is rejected for the same reasons stated above. *See Id.* at 133. Bio-Rad has not demonstrated that Drs. Hindson and Saxonov were under any obligation to Bio-Rad with respect to the asserted 10X patents.

The “shop rights” defense similarly is predicated on the assertion that Drs. Hindson and Saxonov “‘conceived’ of the claimed inventions of the Asserted Patents while employed by and under contract at QuantaLife and/or Bio-Rad—or at the very least significantly and extensively contributed to the conception, development or making of the claimed inventions of the Asserted Patents – and did so using their employer’s resources and personnel.” *Id.* at 134-135.³³ As discussed above, the evidence does not show that Drs. Hindson and Saxonov conceived of the claimed inventions while under contract to QuantaLife and/or Bio-Rad, and the contracts that determine Bio-Rad’s rights do not cover “contributions” made by employees during the course of their employment to inventions conceived after the employment ends. Accordingly, the shop rights doctrine affords Bio-Rad no defense.

³³ “The doctrine of shop rights has its origins in equity. A shop right is an employer’s nonexclusive right to use an employee’s patented process or invention that was developed during the employee’s hours of employment. The right is based on the employer’s presumed contribution to the invention through materials, time, and equipment.” *California Eastern Labs., Inc. v. Gould*, 896 F.2d 400, 402 (9th Cir. 1990) (citing *U.S. v. Dubilier Condenser Corp.*, 239 U.S. 178 (1933)).

IX. CONCLUSIONS OF LAW

Based on the foregoing, and the record as a whole, it is my final initial determination that there is a violation of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and/or the sale within the United States after importation of certain microfluidic systems and components thereof and products containing same by reason of infringement of certain claims of U.S. Patent No. 9,689,024 (“the ’024 Patent”), U.S. Patent No. 9,695,468 (“the ’468 Patent”), and U.S. Patent No. 9,856,530 (“the ’530 Patent”). There is no violation with respect to U.S. Patent No. 9,644,204 (“the ’204 Patent”).

This determination is based on the following conclusions of law:

1. The Commission has subject matter jurisdiction over this investigation, *in personam* jurisdiction over Bio-Rad, and *in rem* jurisdiction over the accused microfluidic systems and components thereof and products containing same.
2. There has been an importation into the United States, sale for importation, or sale within the United States after importation of the accused microfluidic systems and components thereof and products containing same by Bio-Rad.
3. Bio-Rad has indirectly infringed claims 1, 5, 17, 19, and 22 of the ’024 patent with respect to its ddSEQ v1 products.
4. Bio-Rad has indirectly infringed claims 1, 6, 7, 9, and 21 of the ’468 patent with respect to its ddSEQ v1 products.
5. 10X has not shown that any claims of the ’204 patent are infringed by Bio-Rad.
6. Bio-Rad has indirectly infringed claims 1, 4, 11, 14, 19, 26, and 28 of the ’530 patent with respect to its ddSEQ v1 products.
7. No claims of the ’024 patent have been shown to be invalid.
8. No claims of the ’468 patent have been shown to be invalid.
9. No claims of the ’204 patent have been shown to be invalid.
10. No claims of the ’530 patent have been shown to be invalid.
11. The domestic industry requirement is satisfied with respect to claims of the ’024

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patent.

12. The domestic industry requirement is satisfied with respect to claims of the '468 patent.
13. The domestic industry requirement is satisfied with respect to claims of the '204 patent.
14. The domestic industry requirement is satisfied with respect to claims of the '530 patent.
15. Bio-Rad has failed to carry its burden with respect to its allegations of improper inventorship, ownership, and other affirmative defenses.

I hereby certify the record in this investigation to the Commission with my final initial determination. Pursuant to Commission Rule 210.38, the record further comprises the Complaint and exhibits thereto filed with the Secretary, the *Markman* order, and the exhibits attached to the parties' summary determination motions and the responses thereto. 19 C.F.R. § 210.38(a).

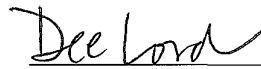
Pursuant to Commission Rule 210.42(c), this initial determination shall become the determination of the Commission 45 days after the service thereof, unless a party files a petition for review pursuant to Commission Rule 210.43(a), the Commission orders its own review pursuant to Commission Rule 210.44, or the Commission changes the effective date of the initial determination. 19 C.F.R. § 210.42(h)(6).

This initial determination is being issued with a confidential designation pursuant to Commission Rule 210.5 and the protective order in this investigation. Within ten (10) days of the date of this initial determination, each party shall submit to the Administrative Law Judge a statement as to whether or not it seeks to have any portion of this document deleted from the public version. See 19 C.F.R. § 210.5(f). A party seeking to have a portion of this document deleted from the public version thereof must attach to its submission a copy of the document with red brackets indicating the portion(s) asserted to contain confidential business

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information.³⁴ The parties' submissions under this subsection shall not be filed with the Commission Secretary but shall be submitted by paper copy to the Administrative Law Judge and by e-mail to the Administrative Law Judge's attorney advisor.

SO ORDERED.



Dee Lord
Administrative Law Judge

³⁴ To avoid depriving the public of the basis for understanding the result and reasoning underlying the decision, redactions should be limited. Parties who submit excessive redactions may be required to provide an additional written statement, supported by declarations from individuals with personal knowledge, justifying each proposed redaction and specifically explaining why the information sought to be redacted meets the definition for confidential business information set forth in Commission Rule 201.6(a). 19 C.F.R. § 201.6(a).

**CERTAIN MICROFLUIDIC SYSTEMS AND
COMPONENTS THEREOF AND PRODUCTS
CONTAINING SAME**

Inv. No. 337-TA-1100

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **INITIAL DETERMINATION** has been served by hand upon the Commission Investigative Attorney, **Monica Bhattacharyya, Esq.**, and the following parties as indicated, on **August 12, 2019**.



Lisa R. Barton, Secretary
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