

UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE PATENT TRIAL AND APPEAL BOARD

EMBODY, INC., AND ZIMMER  
BIOMET HOLDINGS, INC.,

Petitioner,

v.

IPR2025-00248

U.S. Patent No. 10,137,223

LIFENET HEALTH,

Patent Owner.

VIDEOTAPED DEPOSITION OF

DR. DAVID G. SIMPSON

October 7, 2025

9:04 a.m. - 3:24 p.m.

1                   Videotaped Deposition of DR. DAVID  
2   G. SIMPSON, taken and transcribed on behalf  
3   of the Patent Owner, stenographically  
4   reported by Kimberly L. Ribaric, Registered  
5   Professional Reporter, Certified Court  
6   Reporter and e-Notary Public in and for the  
7   Commonwealth of Virginia at large, pursuant  
8   to 37 C.F.R. § 42.53, and by Notice to Take  
9   Depositions; commencing at 9:04 a.m.,  
10   October 7, 2025 at Woods Rogers Vandeventer  
11   Black PLC, 901 East, Byrd Street, Suite 1600,  
12   Richmond, Virginia 23219.

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13  
14 ALSO PRESENT:

15 DeShawn White, Videographer  
16  
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18  
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I N D E X

|                               |      |
|-------------------------------|------|
| WITNESS: DR. DAVID G. SIMPSON | PAGE |
| Examination By Ms. Wieker     | 8    |
| Examination By Mr. Levine     | 208  |

- - -

## E X H I B I T S

## DEPOSITION

| EXHIBIT NO. |                                                                                                                                               | PAGE |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|
| Exhibit 1   | Declaration of David G. Simpson,<br>Ph.D. in Support of Petition for<br>Inter Partes Review of U.S. Patent<br>No. 10,137,223                  | 14   |
| Exhibit 2   | Declaration of David G. Simpson,<br>Ph.D. in Support of Petition for<br>Inter Partes Review of U.S. Patent<br>No. 11,318,227                  | 15   |
| Exhibit 3   | "Electrospun nanofiber scaffolds:<br>engineering soft tissues"                                                                                | 40   |
| Exhibit 4   | "Measuring fiber alignment in<br>electrospun scaffolds: a user's<br>guide to the 2D fast Fourier<br>transform approach"                       | 81   |
| Exhibit 5   | Broad peak drawing                                                                                                                            | 101  |
| Exhibit 6   | "Biomaterials"                                                                                                                                | 132  |
| Exhibit 7   | "Modulation of anisotropy in<br>electrospun tissue-engineering<br>scaffolds: Analysis of fiber<br>alignment by the fast Fourier<br>transform" | 145  |

## E X H I B I T S

(Continued)

| EXHIBIT NO. | PAGE                                                                                                                |
|-------------|---------------------------------------------------------------------------------------------------------------------|
| Exhibit 8   | Lee publication 152                                                                                                 |
| Exhibit 9   | Provisional Patent filings 154                                                                                      |
| Exhibit 10  | "Cross-Linking Electrospun Type II 185<br>Collagen Tissue Engineering<br>Scaffolds with Carbodiimide in<br>Ethanol" |
| Exhibit 11  | U.S. Patent 5,514,378 194                                                                                           |
| Exhibit 12  | U.S. Patent Application 197<br>Publication, Kuo, et al.                                                             |
| Exhibit 13  | U.S. Patent 10,137,223 200                                                                                          |
| Exhibit 14  | VCU College of Engineering News 202                                                                                 |

(October 7, 2025, 9:04 a.m.)

P R O C E E D I N G S

- - -

THE VIDEOGRAPHER: We are now on the record. My name is DeShawn White, I am a videographer retained by Lexitas. This is a video deposition for the United States Patent and Trademark Office. Today's date is October 7th, 2025, and the time on the video is 9:04 a.m.

This deposition is being held at Woods Rogers Vandeventer Black, PLC, 901 East Byrd Street, Richmond, Virginia, in the matter of Embody Inc., et al., versus LifeNet Health. The deponent is Dr. David Simpson.

Counsel, would you please identify yourselves for the record, followed by Kim Ribaric to swear in the witness.

MS. WIEKER: For LifeNet Health, this is Amanda Wieker with McGuireWoods.

MR. LEVINE: For petitioners, this is Howard Levine from Hogan Lovells, and also representing the witness.

- - -

DR. DAVID G. SIMPSON,

1 first duly sworn, testified as follows:

2 - - -

3 EXAMINATION

4 BY MS. WIEKER:

5 Q. Good morning. So like I said, my name  
6 is Amanda Wieker, I'm a partner at McGuireWoods,  
7 I'm representing LifeNet Health in these matters.

8 Can you please tell me your name?

9 A. David Simpson.

10 Q. Thank you. Have you been deposed  
11 before, Dr. Simpson?

12 A. No.

13 Q. Okay. I'd like to quickly review the  
14 basics of how today's going to go.

15 During the deposition, I will ask you a  
16 series of questions that you will answer. We are  
17 joined by Ms. Ribaric, who is a court reporter,  
18 and will transcribe everything we discuss. So to  
19 that end, it's important that you give verbal oral  
20 answers to the questions and try to refrain from  
21 hand gestures or head movements. Do you  
22 understand?

23 A. Yes.

24 Q. Thank you.

25 It's also important that we not talk

1 over each other so that we have a transcription  
2 that we can use. So I will try to pause after  
3 every question to give you time to collect your  
4 thoughts and answer, and I'd ask that you do the  
5 same, please.

6 Your testimony today is under oath; that  
7 means that you're obligated to tell the truth as  
8 if we were in court with a judge present. Do you  
9 understand?

10 A. Yes.

11 Q. Additionally, you must answer all of the  
12 questions I ask you unless you are instructed not  
13 to -- to answer by Mr. Levine.

14 Do you understand?

15 A. Yes.

16 Q. Thank you.

17 Now, my job today is to ask you clear  
18 questions that you can understand. So if I ask  
19 something that you don't understand, please let me  
20 know; I'll rephrase it or repeat it.

21 That being said, if you answer a  
22 question, can we agree that it's fair to assume  
23 that you understood the question I asked?

24 A. Yes.

25 Q. In asking my questions today, I may show

1 you certain documents. Please take your time to  
2 review them before answering.

3 And if you refer to a document when  
4 you're answering one of my questions, please just  
5 let me know the exhibit number and the page that  
6 you're referring to if it's not clear from the  
7 context of the question.

8 Finally, I will plan to take breaks  
9 throughout the course of this deposition. We can  
10 break at any time that you need, just please let  
11 me know. The only caveat is that if there is a  
12 pending question, I'll need you to answer that  
13 before we take a break. But otherwise, we can --  
14 we can break when you need one.

15 Okay. Let's get started.

16 Dr. Simpson, is there anything that  
17 would prevent you from testifying truthfully and  
18 accurately today?

19 A. No.

20 Q. Did you bring any documents with you to  
21 the deposition today?

22 A. I did not.

23 Q. Okay. Did you prepare for this  
24 deposition?

25 A. Yes.

1 Q. Okay. How did you do that?

2 A. I met with the attorneys from Hogan  
3 Lovells and we discussed how this would play out.

4 MR. LEVINE: Go ahead.

5 BY MS. WIEKER:

6 Q. When did you meet with counsel?

7 A. Sunday and yesterday.

8 Q. Okay. And where did that happen?

9 A. In this room.

10 Q. Okay. Approximately how many hours did  
11 you meet with counsel?

12 A. Eight, nine. I think four hours and  
13 five hours.

14 Q. Okay.

15 MR. LEVINE: Dr. Simpson, I can't tell  
16 you --

17 THE WITNESS: I know. I'm looking at --  
18 I'm not looking at you to answer for me; I'm  
19 just looking, thinking, how many hours did I  
20 look at Howard?

21 MR. LEVINE: All right.

22 BY MS. WIEKER:

23 Q. Did anyone else participate in that  
24 meeting with you?

25 A. The other attorney.

1 Q. Uh-huh. Okay. Other than counsel, did  
2 you speak with anyone to prepare for this  
3 deposition?

4 A. No.

5 Q. Okay. Did you review any documents to  
6 prepare for this deposition?

7 MR. LEVINE: And, Dr. Simpson, I  
8 instruct you to answer that question "yes,"  
9 "no," or "I don't recall."

10 THE WITNESS: Yes.

11 BY MS. WIEKER:

12 Q. Okay. You have offered opinions on  
13 behalf of Embody, Inc. and Zimmer Biomet Holdings;  
14 is that right?

15 A. Yes.

16 Q. Okay. If I refer to these entities as  
17 "petitioner," do you understand who I'm referring  
18 to?

19 A. Yes.

20 Q. Okay. When were you first retained by  
21 petitioner?

22 A. Probably about -- I'm guessing. I think  
23 it was probably about mid summer, late summer last  
24 year.

25 Q. Who first contacted you about providing

1 testimony?

2 A. I can't be sure.

3 Q. Okay. Your opinions are offered in  
4 connection with two proceedings before the Patent  
5 Trial and Appeal Board; is that right?

6 A. Yes.

7 Q. Okay. And if I refer to that entity as  
8 the "PTAB," will you understand what I mean?

9 A. Yes.

10 Q. Okay. Have you been retained as an  
11 expert witness in any other proceeding before the  
12 PTAB?

13 A. No.

14 Q. Okay. Have you been retained as an  
15 expert witness in any litigation proceeding  
16 before?

17 A. No.

18 Q. Okay. One of the proceedings here is  
19 IPR2025-00248, correct?

20 A. I'm not familiar -- what's -- I'm not  
21 familiar with that number.

22 Q. Okay. We'll return to that.

23 In these proceedings, did you offer two  
24 declarations?

25 A. Yes.

1 MS. WIEKER: Okay. So I'd like to  
2 introduce an exhibit into the record.  
3 Ms. Ribaric, can you mark -- mark this as  
4 Exhibit 1 for identification.

5 (Simpson Deposition Exhibit 1 marked for  
6 identification.)

7 THE WITNESS: That's my Declaration  
8 '223.

9 MR. LEVINE: There's no question pending  
10 now.

11 BY MS. WIEKER:

12 Q. Dr. -- Dr. Simpson, do you recognize  
13 Exhibit 1?

14 A. I do.

15 Q. Okay. And do you see on the front page,  
16 it says, under the -- the party names, it says:  
17 Case Number IPR2025-00248?

18 A. I --

19 Q. Is that right?

20 A. Yes.

21 Q. Okay. If I refer to this proceeding as  
22 the "'248 IPR," will you understand what I'm  
23 referring to?

24 A. Yes.

25 Q. Okay. Thank you.

1           And you'll see this report, there's on  
2     the face U.S. Patent Number 10,137,223; is that  
3     correct?

4           A.    Yes.   Yes.

5           Q.    So if I refer to that patent number as  
6     the "'223 Patent," will you understand what I'm  
7     referring to?

8           A.    Yes.

9           MS. WIEKER:   Okay.   Thank you.   Go ahead  
10    and mark the second exhibit, please.

11               (Simpson Deposition Exhibit 2 marked for  
12               identification.)

13           MR. LEVINE:   Thank you.

14   BY MS. WIEKER:

15           Q.    Dr. Simpson, do you recognize what I  
16     have handed to you as Exhibit 2?

17           A.    I do.

18           Q.    And you'll see on the face of that  
19     document, it bears the Case Number IPR2025-0049.

20           A.    Yes.

21           Q.    If I refer to that as the "'249 IPR,"  
22     will you understand what I'm referring to?

23           A.    Yes.

24           Q.    And, likewise, the patent number listed  
25     on that report is U.S. Patent Number 11,318,227.

1           If I refer to that as the "'227 Patent,"  
2 will you understand what I'm referring to?

3           A.    Yes.

4           Q.    Excellent.  Now, if an answer today does  
5 not apply to both proceedings, will you please let  
6 me know?

7           A.    Yes.

8           Q.    Otherwise, is it fair to assume your  
9 answers apply to both the '248 IPR and the '249  
10 IPR?

11          A.    No, it's not.

12          Q.    Okay.  Then I'll ask you to, please, for  
13 each answer, tell me which proceeding it does not  
14 apply to.

15          A.    Sure.  Yes.

16          Q.    Okay.  So turning back to Exhibit 1.  Is  
17 this your declaration for the '248 IPR?

18          A.    Yes.

19          Q.    And is that your signature at the end?

20          A.    It is.

21          Q.    Did you write this declaration yourself?

22          A.    I did.

23          Q.    And are these your words?

24          A.    These are my words.

25          Q.    And are these your opinions?

1 A. These are my opinions.

2 Q. Do you have any other opinions about the  
3 '223 Patent that are not reflected in the  
4 declaration?

5 A. '223? Some.

6 Q. What are those opinions?

7 A. A stronger connection between -- I'm  
8 sorry, '223. I'm -- I'm referring to '227.

9 Q. Okay. Well, would you finish your --  
10 that answer about the '227, please?

11 A. The '227 further opinions, a stronger  
12 connection between Huang and Kuo than we may have  
13 represented in this document.

14 Q. And do you have any other opinions about  
15 the '223 Patent that's discussed in the IPR ' '248  
16 Declaration, Exhibit 1?

17 A. No.

18 Q. Okay. Would you please describe the  
19 process for preparing this declaration?

20 A. I met via Zoom with the attorneys and we  
21 talked science. I was provided drafts of any  
22 documents that were to be used for the opportunity  
23 to edit and augment them, and that process went  
24 back and forth several times.

25 Q. When you say you were provided drafts of

1 documents and you had the opportunity to edit  
2 them, are you referring to a draft of your  
3 declaration or something else?

4 A. The declarations.

5 Q. Okay. Who provided the first draft of  
6 the declarations?

7 A. The attorneys.

8 Q. Did the attorneys provide edits to your  
9 declaration?

10 A. They certainly organized it to represent  
11 what the IPR board would want in a legal document.

12 Q. Did counsel edit the technology or the  
13 substantive opinions?

14 A. No.

15 Q. Okay. Other than counsel, did anyone  
16 assist you in preparing the ' '248 Declaration  
17 regarding the '223 Patent?

18 A. No.

19 Q. After you submitted the '248 IPR  
20 Declaration on November 29th, 2024, did you  
21 discover any errors in the declaration that you  
22 would like to change?

23 A. No.

24 Q. Since you started working on the '248  
25 IPR, how much time have you spent on it?

1       A.    I can't give an exact account -- I can't  
2 even give a remote accounting of that. I don't  
3 know.

4       Q.    How much time have you billed for your  
5 work --

6       A.    I have not submitted a bill yet.

7       Q.    Do you have any financial interest in  
8 the outcome of this matter?

9       A.    I do not.

10      Q.    Are there any materials you relied on in  
11 forming your opinions on the IPR '248 that are not  
12 listed in the declaration?

13      A.    It's complete.

14      Q.    Thank you.

15            At paragraph 7 of the declaration, you  
16 state that you've been a professor since 2000 --  
17 since 2000 at Virginia Commonwealth University.  
18 Is that correct?

19      A.    Yes.

20      Q.    In that role, do you teach or advise  
21 students in the area of electrospun fibers?

22      A.    Not for a number of years.

23      Q.    Did you in the past?

24      A.    I had students in the laboratory.

25      Q.    And when was that?

1       A.    My last student was approximately six  
2   years ago.

3       Q.    And when did you begin having students  
4   in the lab investigating electrospun fibers?

5       A.    We started the early work about 2002.  I  
6   probably didn't have anybody until about 2003 or  
7   '04.

8       Q.    So is it fair to say that starting in  
9   the early 2000s, somewhere between 2002 and 2004,  
10   you began having students in the lab working on  
11   electrospun fibers, and that carried over until  
12   about six years ago, or approximately 2019?

13      A.    Yes.

14            And I think I'd like to make a minor  
15   correction.

16      Q.    Uh-huh.

17      A.    I think maybe the start of that was  
18   about 2001.

19      Q.    Okay.  So from approximately 2001 until  
20   2019, you advised students in the lab  
21   investigating electrospun fibers; is that right?

22      A.    Among other things, yes.

23      Q.    Okay.  Thank you.

24            Do you teach or advise students  
25   regarding Fast Fourier Transform analysis?

1 A. I do not.

2 Q. Have you ever?

3 A. I believe that I did not -- I did teach.

4 I did teach. I did teach.

5 Q. And when was that?

6 A. That was when we started exploring how  
7 the Fast Fourier Transform could be used in the  
8 lab.

9 Q. And when did you start exploring how the  
10 Fast Fourier Transform could be used in the lab?

11 A. I think that was probably about 2002.

12 Q. And have you ceased that work?

13 A. I have.

14 Q. When did you stop exploring Fast Fourier  
15 Transform?

16 MR. LEVINE: Objection to the form of  
17 the question.

18 BY MS. WIEKER:

19 Q. Dr. Simpson, did you testify that you  
20 stopped -- I'll rephrase.

21 Dr. Simpson, are you still working on  
22 Fast Fourier Transform analysis?

23 A. Not beyond what we've done here.

24 Q. At VCU, when did you stop working on  
25 Fast Fourier Transform analysis?

1       A.   Probably about the time I -- I closed my  
2   laboratory.

3       Q.   And when did you close your laboratory?

4       A.   That's six years ago.

5       Q.   Okay.  So please correct me if I'm  
6   wrong.  I believe you had stated that you taught  
7   students regarding Fast Fourier Transform analysis  
8   during the period in which your lab was exploring  
9   it, which was approximately 2002 until 2019.  Is  
10   that correct?

11      A.   Approximately, yes.

12      Q.   Okay.  And for our purposes today, if I  
13   refer to Fast Fourier Transform analysis as "FFT  
14   analysis," will you understand what I'm referring  
15   to?

16      A.   Yes.

17      Q.   Okay.  Thank you.  All right.  Let's  
18   turn back to Exhibit 2, please.

19               Is this your declaration for the '249  
20   IPR?

21      A.   It is.

22      Q.   And is it your signature at the end?

23      A.   It is.

24      Q.   Did you write this declaration yourself?

25      A.   I did.

1 Q. Do you have any other opinions about the  
2 '227 Patent that are not reflected in this  
3 declaration?

4 A. In -- as noted in my opinion before, I  
5 think there's a much stronger connection between  
6 Huang 2 and Kuo than I realized at the time this  
7 document was finished.

8 Q. At the time you drafted the IPR '249  
9 Declaration, did you have in your possession the  
10 Huang 2 reference and the Kuo reference?

11 A. I did.

12 Q. Okay. Had you studied those documents  
13 before preparing your declaration?

14 A. Yes.

15 Q. Did the process for preparing this  
16 declaration vary from that you described for  
17 preparing the '248 IPR Declaration?

18 A. It did not.

19 Q. Okay. After you submitted the IPR '249  
20 Declaration on November 29th, 2024, did you  
21 discover any errors in it that you would like to  
22 change?

23 A. I did not.

24 Q. Since you started working on the '249  
25 IPR, how much time have you spent on it?

1       A.    Like my answer with '223, I -- I don't  
2 know because we worked on them simultaneously.

3       Q.    So you worked on them simultaneously. I  
4 think you're referring to the '248 IPR and the  
5 '249 IPR?

6       A.    Yes.

7       Q.    Can you approximate how much you've --  
8 time you've spent on the two -- two combined?

9       A.    I just don't know. And I said -- as I  
10 said before, I have not submitted a bill.

11      Q.    Would you approximate you spent five  
12 hours on it?

13      A.    Certainly more than that.

14      Q.    Would you approximate ten hours?

15      A.    Certainly more than that.

16      Q.    Would you approximate 50 hours?

17      A.    Not 50.

18      Q.    Would you approximate 30?

19      A.    I don't know. Somewhere between 15 and  
20 50.

21      Q.    For both IPRs together?

22      A.    Yes.

23      Q.    And are there any materials you relied  
24 on in forming your opinions that are not listed in  
25 the '248 -- I'm sorry. Strike that.

1           Are there any materials you relied on in  
2 forming your opinions that are not listed in the  
3 '249 IPR Declaration?

4           A.    There are not.  It's complete.

5           Q.    Thank you.  Okay.

6           Could you please turn to the ' '248  
7 Declaration, which is marked as Exhibit 1, and  
8 turn to paragraph 14, please.

9           In that paragraph, you mention  
10 transferring your patent portfolio to a start-up  
11 company that's producing a high performance  
12 hemostatic bandage.

13           Do you see that?

14           A.    Yes.

15           Q.    Okay.  Does that bandage comprise  
16 collagen?

17           A.    No.

18           Q.    What is the material that makes up that  
19 bandage?

20           A.    Dextran.

21           Q.    Does that bandage comprise electrospun  
22 materials?

23           A.    It does.

24           Q.    Are they aligned?

25           A.    No.

1 Q. Does the bandage use cross-linking?

2 A. No.

3 Q. What are the applications for the  
4 bandage?

5 A. External hemostatic wounds, bleeding  
6 wounds.

7 Q. Has it received regulatory approval in  
8 the United States?

9 A. No. That company went bankrupt.

10 Q. Okay.

11 A. No longer exists.

12 Q. Is it fair to assume then it's not being  
13 sold in New Zealand either?

14 A. No, that's right. Yeah. No.

15 Q. Okay. Would you turn to paragraph 28,  
16 please, this is on page 16.

17 A. Pardon me.

18 Q. Are you familiar with the concept of a  
19 person of ordinary skill in the art?

20 A. I am.

21 Q. And if I refer to that conceptual  
22 hypothetical person as a "POSITA," will you  
23 understand --

24 A. Yes.

25 Q. -- what I'm referring to? Okay. Thank

1 you.

2           You state that: In my opinion, the  
3 person of ordinary skill in the art -- let me make  
4 sure I'm getting this exactly right. I'll start  
5 that question again.

6           You state: In my opinion, the person of  
7 ordinary skill for the purposes of the '223 Patent  
8 would be a Ph.D. student with a minimum of two  
9 years of experience in their faculty advisor's  
10 laboratory.

11           Is that correct?

12           A. Yes.

13           Q. Does the same opinion hold for the '227  
14 Patent?

15           A. It does.

16           Q. Did you come up with this definition of  
17 a POSITA?

18           A. I did.

19           Q. What is the basis for that definition?

20           A. My experience with students.

21           Q. What experience with students led you to  
22 determine two years' experience in their faculty  
23 advisor's laboratory is appropriate?

24           A. The first author on the two  
25 electrospinning papers in this document discussing

1 FFTs were written by my second-year student.

2 Q. And is -- is that Ms. Ayres, A-Y-R-E-S?

3 Am I saying --

4 A. Yes.

5 Q. Am I saying that --

6 A. Ayres.

7 Q. Ayres.

8 A. Yeah.

9 Q. Okay.

10 As of March 14th, 2013, did your level  
11 of skill in the art match the definition you  
12 provided in paragraph 28 of the '248 IPR  
13 Declaration?

14 A. Of 2013?

15 Q. Uh-huh.

16 A. Most certainly.

17 Q. Was your experience greater than this  
18 definition?

19 A. No.

20 Q. So in 2013, you were a Ph.D. student  
21 with a minimum of two years' experience in their  
22 faculty advisor's laboratory?

23 A. I was a Ph.D. with a minimum of two  
24 years of experience.

25 Q. Right. Can you read your definition of

1 the POSITA for me, please?

2 A. In my opinion, the person of ordinary  
3 skill and for the purposes of the '223 Patent  
4 would be a Ph.D. student with a minimum of two  
5 years of experience in the faculty advisor's  
6 laboratory.

7 At this stage of graduate training, a  
8 Ph.D. student is expected to establish and design  
9 an independent research project in the pursuit of  
10 their degree.

11 This level of expertise was long  
12 expected of graduate students in my laboratory and  
13 the laboratories of my principal collaborators.

14 At the relevant time, a POSA would have  
15 understood the following technologies and  
16 techniques: Electrospinning fibers, including  
17 tissue engineering, electrospinning fibers,  
18 including tissue engineering, tissue engineering  
19 techniques, and using FFT analysis in performing  
20 such analysis.

21 My opinion discussed herein would not  
22 change due to the moderately lesser or greater  
23 level of experience.

24 All of my opinions in this declaration  
25 are from the perspective of one of ordinary in the

1 skill of the art, as I have defined here at the  
2 relevant time, 2013.

3 During this period, I possessed at least  
4 the qualifications of the person ordinary skilled  
5 in the art as defined above.

6 And I reflect on the last sentence:  
7 During this period of time, I possessed at least  
8 the qualifications of a person of ordinary skill  
9 in the art as defined above.

10 Q. So in the second -- second line of  
11 paragraph 28 where you say, "this person would be  
12 a Ph.D. student," is your testimony that the  
13 POSITA is a Ph.D. student or a Ph.D. who has in  
14 the past been a student?

15 A. A student who is a Ph.D. student two  
16 years in their mentor's laboratory --

17 Q. Okay.

18 A. -- who is not a Ph.D. yet, but they're a  
19 student in pursuit of their Ph.D.

20 Q. Okay. So when I asked earlier was your  
21 experience greater than this definition, you  
22 answered no.

23 A. I looked at the sentence that says, "At  
24 the relevant time, a POSA would have understood  
25 the following technologies and techniques:

1 Electrospinning fibers" -- I have that  
2 experience -- "including for tissue  
3 engineering" -- I have that experience -- "tissue  
4 engineering techniques" -- I have that experience.

5 And I've certainly used FFT in  
6 performing the analysis of those structures. I  
7 meet those minimum requirements.

8 Q. I understand your testimony there.

9 My question is still -- I just want to  
10 be sure we're understanding each other.

11 Your definition of a POSITA is a Ph.D.  
12 student with a minimum of two years' experience,  
13 correct?

14 A. In the mentor's laboratory, yes.

15 Q. Thank you.

16 And in 2013, you were not a Ph.D.  
17 student, correct?

18 A. No.

19 Q. Okay.

20 A. I was a Ph.D.

21 Q. So would -- would you characterize your  
22 experience level as greater than that of a Ph.D.  
23 student with a minimum of two years of experience  
24 in their faculty advisor's laboratory?

25 A. I think I'd like to have a definition of

1 "experience."

2 Q. Well, Dr. Simpson, this is your -- your  
3 declaration, is it not?

4 A. Yes.

5 Q. So when you used the word "experience,"  
6 what do you mean?

7 A. You have been exposed to those  
8 techniques and are able to do them.

9 Q. So in 2013, was your experience greater  
10 than that of a Ph.D. student with a minimum of two  
11 years of experience in their faculty advisor's  
12 laboratory?

13 A. I was in -- I was running my laboratory  
14 for all that time. I don't know that I actually  
15 had more experience than any of the students  
16 because the students conducted the research.

17 Q. So then why was your definition crafted  
18 to be a Ph.D. student with a minimum of two years  
19 of experience in their faculty advisor's  
20 laboratory?

21 A. Because in my judgment, the opinions in  
22 this document could be reached by someone who is a  
23 POSA with those qualifications.

24 Q. So your view is that in -- as of  
25 March 14th, 2013, your level of skill in the art

1 was equal to that of a Ph.D. student with a  
2 minimum of two years of experience in their  
3 faculty advisor's laboratory; is that correct?

4 A. With these specific techniques as listed  
5 there.

6 Q. When did you earn your Ph.D.?

7 A. 1996.

8 Q. In that same paragraph we were referring  
9 to, paragraph 28, about two-thirds of the way  
10 down, you read the sentence: My opinions  
11 discussed herein would not be changed due to a  
12 modestly lesser or greater level of experience.

13 A. I see that.

14 Q. What did you mean by that statement?

15 A. A student that had been practicing these  
16 techniques for 4 years or someone who had been  
17 practicing it for 18 months could certainly have  
18 the ability to meet the criteria of a POSA.

19 Q. What about someone who had been  
20 practicing for 17 years?

21 A. Of course.

22 Q. Would any opinions change if the skill  
23 level differed by more than a modest level?

24 A. If the skill? Certainly. There are  
25 some people that are much better than others.

1 Q. Okay. Would any opinions change if more  
2 than a modestly lesser or greater level of  
3 experience was obtained?

4 A. I don't believe so.

5 Q. Then why did you include this statement?

6 A. Some students are slower than others.  
7 Some students are faster than others at acquiring  
8 new skills.

9 Q. So is there a different benchmark we  
10 should be using for defining a POSITA if the years  
11 of experience is not determinative?

12 MR. LEVINE: Objection to the form of  
13 the question.

14 BY MS. WIEKER:

15 Q. What -- would you like to answer?

16 A. (Shakes head side to side.)

17 Q. What definition of POSITA should we be  
18 using if the years of experience is not  
19 determinative?

20 MR. LEVINE: Objection to the form of  
21 the question.

22 THE WITNESS: Use the definition in the  
23 document as stated; two years in the mentor's  
24 laboratory.

25

1 BY MS. WIEKER:

2 Q. So turning back to your statement: My  
3 opinions discussed herein would not be changed due  
4 to a modestly lesser or greater level of  
5 experience.

6 In what circumstance would your opinions  
7 discussed herein be changed?

8 A. They wouldn't be.

9 Q. So then what does this statement  
10 reflect?

11 A. Read that sentence again, please. Which  
12 sentence are you referring to?

13 Q. About two-thirds of the way through  
14 paragraph 28, it starts, "My opinions discussed  
15 herein."

16 A. Oh, yeah.

17 Q. Why don't you go ahead and read it out  
18 loud.

19 A. My opinions discussed herein would not  
20 change due to modestly lesser or greater level of  
21 experience.

22 They would not.

23 Q. So there are no circumstances in which  
24 your opinions here would change?

25 A. No.

1 Q. So what does that statement convey?

2 Is it incorrect?

3 A. My opinions discussed herein would not  
4 be changed due to a modestly lesser or greater  
5 level of experience.

6 I just said that my opinions would not  
7 be changed.

8 Q. And if it was a more than modest  
9 difference in the level of experience, would your  
10 opinions change?

11 A. I'm afraid I don't really have a  
12 definition of when that might occur or might not  
13 occur.

14 Q. And these are your opinions in paragraph  
15 28?

16 A. Yes.

17 Q. And you don't have perspective on the  
18 word "modestly lesser or greater level of  
19 experience"; is that correct?

20 MR. LEVINE: Objection. Objection.  
21 Mischaracterization.

22 BY MS. WIEKER:

23 Q. Dr. Simpson, how would you describe the  
24 phrase "modestly lesser or greater level of  
25 experience"?

1 MR. LEVINE: Objection. Asked and  
2 answered.

3 BY MS. WIEKER:

4 Q. You can answer the question.

5 A. Oh, answer again? I'm sorry.

6 As I said, 18 months in the laboratory  
7 to 4 years or more in the laboratory.

8 Q. And including 17 years or more?

9 A. No students last 17 years.

10 Q. Can you please turn to paragraph 32 on  
11 page 19. Will you let me know when you're there?

12 A. Yes, I'm there.

13 Q. In this paragraph, you describe  
14 properties of electrospun fibrous scaffolds; is  
15 that right?

16 MS. WIEKER: Excuse me, Mr. Levine,  
17 did -- did you say something?

18 MR. LEVINE: No.

19 MS. WIEKER: Oh, okay.

20 MR. LEVINE: At least I didn't mean to.  
21 What was the question? Can you read the  
22 question back? Yes, please.

23 (Whereupon, the court reporter read back  
24 previous question as requested.)

25 MR. LEVINE: Objection to the form of

1 the question.

2 BY MS. WIEKER:

3 Q. Dr. Simpson, please describe to me what  
4 paragraph 32 discusses.

5 A. The first part of the paragraph  
6 discusses some variables in the electrospinning  
7 process.

8 And the second part of it simply states  
9 that you can make aligned fibers if you want to.

10 Q. And in this paragraph, you state: The  
11 properties of the resulting fibrous scaffold  
12 depend on several factors, such as the polymer's  
13 molecular weight, the solution composition, flow  
14 rate, charge, the distance between the syringe and  
15 the collector, and the motion and charge of the  
16 collector --

17 A. Yes.

18 Q. -- end quote.

19 Is that still your opinion?

20 A. Yes.

21 Q. And what are you referring to here when  
22 you say, "properties of the resulting fibrous  
23 scaffold"?

24 A. These are the starting -- some of the  
25 starting conditions in the electrospinning

1 process.

2 Q. Right. The recited elements like  
3 molecular weight, composition, et cetera.

4 But when you say, "properties of the  
5 resulting fibrous scaffold," what properties are  
6 you referring to?

7 A. Its composition, the fiber size, its  
8 orientation.

9 Q. Any other properties?

10 A. Those are the basics.

11 Q. When you say "orientation," is that  
12 synonymous with alignment or do you mean something  
13 different from alignment?

14 A. Orientation and alignment in this case  
15 can be interchangeable.

16 Q. Okay. You agree that pore size and  
17 porosity also depend on the several factors listed  
18 in paragraph 32; is that correct?

19 A. Indirectly.

20 Q. Can you elaborate on that, please?

21 A. A fiber deposits on a target, and the  
22 target in the case here is Figure -- Figure 3. It  
23 has a charge because it's been in an electric  
24 field.

25 If it's a small fiber, it will tend to

1 be pushed away from adjacent fibers.

2 If it's a large fiber, it tends not to  
3 be pushed away as far.

4 Ultimately, it's -- it's the -- it's the  
5 specific properties of a polymer and how it's  
6 charged that affect that.

7 Q. And when you say "small fiber" or "large  
8 fiber," are you referring to fiber diameter?

9 A. Yes.

10 Q. Okay. And what impacts how the polymer  
11 is charged?

12 A. It's in a static electric field. That's  
13 the definition of electrospinning.

14 Q. Uh-huh. And how does the polymer become  
15 charged?

16 A. An electric field is applied to the  
17 starting polymer.

18 MS. WIEKER: I'd like to mark this as  
19 Exhibit 3, please.

20 (Simpson Deposition Exhibit 3 marked for  
21 identification.)

22 BY MS. WIEKER:

23 Q. Dr. Simpson, do you recognize what I've  
24 handed to you as Exhibit 3?

25 A. I do.

1 Q. Would you consider this publication to  
2 be a reliable source of information for a person  
3 of ordinary skill in the art?

4 A. It is a review article. It is a  
5 peer-reviewed article.

6 Q. I appreciate that. Would you -- would  
7 you answer my question?

8 Would you consider this publication to  
9 be a reliable source of information for a person  
10 of ordinary skill in the art?

11 A. I would.

12 Q. Okay. And if I remember to the  
13 publication by the name of the first listed  
14 author, "Kumbar," will you understand what I mean?

15 A. I will.

16 Q. Okay. Can you turn to the bottom of  
17 page 3, please.

18 A. I'm there.

19 Q. Thank you.

20 Could you read the first sentence at the  
21 bottom? It begins, "Various parameters." It's a  
22 long sentence. It continues down to -- to the  
23 bottom of that column, almost the bottom of the  
24 column.

25 A. Various parameters that potentially

1 affect electrospinning include polymer molecular  
2 weight, polymer solution properties, applied  
3 electric -- electrical potential, polymer solution  
4 flow rate, distance between the spinneret and  
5 collector, i.e., the working distance, motion of  
6 the grounded target in ambient parameters,  
7 including temperature, humidity, and air velocity,  
8 nanofiber diameter, surface morphology, mechanical  
9 properties, porosity, and pore size distribution  
10 greatly depend on these parameters selected for  
11 electrospinning.

12 Q. Thank you.

13 So where Kumbar states that, "Porosity  
14 and pore size distribution greatly depend on the  
15 parameters selected for electrospinning," do you  
16 agree with that statement?

17 A. Well, not all of those variables will  
18 affect the porosity. But certainly  
19 electrospinning conditions affect porosity.

20 Q. Okay. Which of the parameters listed do  
21 not affect porosity?

22 A. In my experience, the most significant  
23 variable is the conditions that produce specific  
24 fiber sizes.

25 Q. And which parameters produce specific

1 fiber sizes?

2 A. The most significant there is probably  
3 polymer molecular weight and polymer solution  
4 properties.

5 Q. Okay. Thank you.

6 You can turn back to Exhibit 1. And  
7 still on paragraph 32, please.

8 A. That's '223?

9 Q. Yes. Thanks.

10 So in paragraph 32, you identified and  
11 read earlier six factors that "influence" -- I'm  
12 sorry -- that influence "the properties of the  
13 resulting fibrous scaffold."

14 Do each of the six factors play an equal  
15 role in determining properties of the resulting  
16 fibrous scaffold?

17 A. Many of those travel together in a  
18 system, but I would hazard a guess that there is  
19 not equal -- they're not equal in -- in  
20 importance.

21 Q. Would their importance vary depending on  
22 the -- the property we're considering?

23 A. I would say yes, it could.

24 Q. So when considering the property of  
25 fiber diameter, which of these six factors is most

1 important in determining that property?

2 A. I would say solution composition.

3 Q. Okay. And a few minutes ago when  
4 discussing the property of porosity, you stated  
5 that the most important factors for determining  
6 that property would be molecular weight and  
7 solution properties; is that correct?

8 A. No. I believe I said fiber size.

9 Q. Let's go back.

10 Earlier you testified: But certainly  
11 electrospinning conditions affect porosity.

12 Does that sound correct?

13 A. That would be polymer's molecular weight  
14 and the solution composition. Those are the two  
15 main determinants of fiber size.

16 Q. Right. And which of these factors most  
17 importantly determine porosity?

18 A. Fiber size.

19 Q. So indirectly, fiber size is dictated by  
20 molecular weight and solution properties --

21 A. By the starting conditions.

22 MR. LEVINE: Dr. Simpson, let counsel  
23 finish her question, then you can answer.

24 THE WITNESS: Thank you.

25

1 BY MS. WIEKER:

2 Q. I just want to make sure I understand  
3 your testimony here.

4 So is it your view that porosity is  
5 dictated by fiber size?

6 A. Yes.

7 Q. And by "fiber size," you mean fiber  
8 diameter?

9 A. Yes.

10 Q. Okay. And the most important factors  
11 that determine fiber diameter are molecular weight  
12 and solution properties; is that correct?

13 A. Yes.

14 Q. Okay. Perfect. Thank you.

15 Paragraph 32 also discusses the distance  
16 between the syringe and the collector.

17 Do you see that? It's the first  
18 sentence of --

19 A. Oh.

20 Q. -- paragraph 32.

21 Yeah, "the distance between the syringe  
22 and" --

23 A. Yes.

24 Q. -- "the collector"?

25 And what property does that impact?

1       A.    Can certainly impact fiber size.  It can  
2   also impact how fibers target onto a target  
3   mandrel.  Can also influence how much of an  
4   electric field you have to use.

5       Q.    And when you say it impacts how fibers  
6   target onto a target mandrel, does that impact  
7   orientation and alignment?

8       A.    No.

9       Q.    Okay.  Can you explain to me what you  
10   mean by it can impact how fibers target onto a  
11   target mandrel?

12      A.    In an extreme condition, if the target  
13   is too far away, fibers won't be attracted to the  
14   target.

15      Q.    Uh-huh.

16      A.    As you move the target closer to the  
17   electrospinning source, you can have the  
18   deposition of wet fibers, which is generally --  
19   depending on the application, you're usually  
20   looking for dry fibers.  And so between those  
21   extremes, you will have some variance in fiber  
22   diameter as a result of the distance for a given  
23   starting solution.

24      Q.    Are you familiar with beading in the  
25   context of electrospinning?

1 A. Uh-huh.

2 Q. When does beading occur?

3 A. Beading occurs when the electrospinning  
4 starting solutions don't have sufficient chain --  
5 what are called chain entanglements of the  
6 polymer.

7 Q. And what controls the sufficiency of the  
8 chain entanglements in the starting solution?

9 A. Two major determinants are the size of  
10 the polymer and the concentration of the polymer.

11 Q. And by "the size of the polymer," are  
12 you referring to molecular weight or something  
13 else?

14 A. Molecular weight.

15 Q. Okay. Would you agree that aligned  
16 electrospun fibers have lower porosity than  
17 randomly oriented electrospun fibers?

18 A. That align -- let me make sure I'm clear  
19 on this. That aligned fibers have less porosity?

20 Q. Lower porosity?

21 A. Lower porosity.

22 That's a difficult question to answer,  
23 and I don't know that I can.

24 Q. Do you agree that aligned electrospun  
25 fibers are packed tightly together?

1       A.    They can be.  Not necessarily, but they  
2   can be.

3       Q.    Can you describe to me a circumstance  
4   where aligned electrospun fibers are aligned but  
5   not packed closely together?

6       A.    If the motion of the target is fast  
7   enough or the electric charge on the fibers is  
8   high enough, they'll tend to be separated from one  
9   another.  I mean, it depends on the -- it depends  
10   on the polymer and the fiber size that you're  
11   trying to achieve.

12      Q.    All right.  You mentioned in 32 the  
13   polymer's molecular weight, and we've talked a  
14   little bit about that.

15           Are you familiar with polycaprolactone?

16      A.    I am.

17      Q.    And if I refer to that as "PCL," will  
18   you understand what I mean?

19      A.    Yes.

20      Q.    Okay.  Would the molecular weight of a  
21   collagen and PCL blend differ from the molecular  
22   weight of pure collagen?

23      A.    I think that depends on whether you  
24   measure the -- the molecular weight of the unit in  
25   the solvent when there's a mixture of PCL and a

1 mixture of collagen, or if you're looking at it as  
2 a dry substance.

3 Certainly the identity of collagen  
4 doesn't change in the solution, so it has its own  
5 molecular weight, and the PCL doesn't change its  
6 composition, it has its own molecular weight.

7 They both contribute to the solution  
8 velocity for electrospinning, but they're just  
9 separate entities in that solution.

10 Q. Right. And is the molecular weight of  
11 PCL identical to that of collagen?

12 A. I don't know. I have no idea.

13 Q. Is that something that could be found in  
14 a resource?

15 A. Yes.

16 Q. It's -- it's a knowable quantity?

17 A. It's a knowable -- yes.

18 Q. And we also discussed what you call  
19 "solution composition" in paragraph 32.

20 A. Uh-huh.

21 Q. What do you mean by "solution  
22 composition"?

23 A. The polymers that you're spinning,  
24 whether you choose to add salt or not add salt.  
25 Certainly the temperature of the room can affect

1 some solutions. The temperature of the solution  
2 is important if you're melt spinning, and that's a  
3 case where you're starting out with a solid and  
4 you're heating it as you're spinning it at the  
5 same time.

6 I can't think of anything else off the  
7 top of my head.

8 Q. Do you typically add salt to a collagen  
9 or collagen blend?

10 A. No.

11 Q. Why is that?

12 A. It's not needed.

13 Q. Why is it not needed?

14 A. Usually those materials spin without the  
15 need of adding salt. Adding salt to it changes  
16 the product. At least in my laboratory, we didn't  
17 want to change that.

18 Q. Is salt detrimental to collagen?

19 A. No.

20 Q. Is collagen hydrophobic or hydrophilic?

21 A. It is hydrophobic -- I'm sorry,  
22 hydrophilic. I'm sorry, I got my phobics and  
23 philics crossed.

24 Q. Okay. I understand.

25 And just to be clear for the record,

1 your -- your opinion is collagen is hydrophilic?

2 A. Yes.

3 Q. Thank you.

4 In your view, is viscosity an aspect of  
5 solution composition?

6 A. Yes.

7 Q. Does viscosity impact the properties of  
8 the resulting fibrous scaffold?

9 A. It certainly is the principal  
10 determinant of fiber size.

11 Q. Would the viscosity of a collagen and  
12 PCL blend differ from that of pure collagen?

13 A. In what solution? Just to be clear.

14 Q. Well, I'm trying to understand what you  
15 discuss as solution composition in paragraph 32.

16 And you've indicated solution  
17 composition encompasses the polymers, whether  
18 there's salt, the temperature, whether melt  
19 spinning has occurred, and viscosity.

20 So I'm just trying to narrow down to  
21 just the viscosity aspect of it.

22 A. Okay.

23 Q. So does the viscosity of a PCL and  
24 collagen blend differ from the viscosity of pure  
25 collagen, the solutions are otherwise the same?

1           A.    If I mixed collagen, if I had the same  
2   amount of collagen in solution, and took that same  
3   amount of collagen and put it in solution with  
4   PCL, the viscosity of the resulting mix would be  
5   higher than the isolated pure protein.

6           Q.    And just to be sure I understand, the  
7   blend collagen PCL would have a higher viscosity  
8   than just the collagen?

9           A.    Yes.

10          Q.    Okay. Thank you.

11                So turning back to 32 -- paragraph 32  
12   again, you identify six factors. We've discussed  
13   some of them.

14                If you don't know the factors that are  
15   identified here, can you know what properties are  
16   necessarily present in the resulting scaffold?

17                MR. LEVINE: Objection to the form of  
18   the question.

19                THE WITNESS: I think you're asking --  
20   I'm not -- I'm not quite sure.

21   BY MS. WIEKER:

22                Q.    Well, then why don't -- I'll rephrase it  
23   for you.

24                A.    Yeah, please.

25                Q.    Okay.

1 A. That'll help. That'll help.

2 Q. I'm not --

3 A. I --

4 Q. -- trying to confuse.

5 A. I -- I'm struggling with that --

6 Q. Okay.

7 A. -- how to answer that.

8 Q. So if you're making a fibrous scaffold  
9 through electrospinning --

10 A. Uh-huh.

11 Q. -- and you don't know the polymer's  
12 molecular weight, the solution composition, the  
13 flow rate, the charge, the distance between the  
14 syringe and collector, and the motion and charge  
15 of the collector, do you know what properties are  
16 necessarily present in that resulting scaffold?

17 A. In the actual fibers themselves?

18 Q. Yes.

19 A. Not without measuring or testing them.

20 MS. WIEKER: Okay. Okay. I'm at the  
21 end of this section. I think now might be a  
22 good time for a mid-morning break.

23 MR. LEVINE: Sure.

24 MS. WIEKER: Is that okay?

25 MR. LEVINE: Yeah.

1 THE VIDEOGRAPHER: The time is  
2 10:12 a.m., we are now off the record.

3 (Recess taken at 10:12 a.m., proceedings  
4 resumed at 10:22 a.m.)

5 THE VIDEOGRAPHER: The time is  
6 10:22 a.m., we are now on the record.

7 BY MS. WIEKER:

8 Q. Dr. Simpson, I wanted to just confirm  
9 some dates of your education, please.

10 When did you earn your BS from Ohio  
11 University?

12 A. That must have been ten years after high  
13 school, I believe it was 1986.

14 Q. Okay. And when did you earn your Ph.D.  
15 from Northwestern University?

16 A. I believe that was 1993.

17 Q. Would your CV that was submitted with  
18 your declarations be accurate?

19 A. To the best of my knowledge, yes.

20 Q. Okay. Thank you.

21 All right. Sorry. All right. Turning  
22 back to the document marked as Exhibit 1, which is  
23 your declaration in the '248 IPR regarding the  
24 '223 Patent.

25 A. Yes.

1 Q. Could you please turn to paragraph 39 on  
2 page 22.

3 A. Okay.

4 Q. In this paragraph, you describe a method  
5 of determining fiber alignment through FFT  
6 analysis that involves three identified steps. Is  
7 that correct?

8 A. It identifies the three fundamental  
9 steps.

10 Q. Is this -- by saying paragraph 39  
11 reflects the three fundamental steps, is that  
12 presenting a high level overview of FFT analysis?

13 A. Yes.

14 Q. Okay. And would you agree that those  
15 three high level steps include first, capturing an  
16 image, second, applying 2D FFT to create a 2D  
17 output image, and third, processing that output  
18 image to create a 2D alignment plot; is that  
19 correct?

20 A. Yes.

21 Q. And if I use the phrase "FFT alignment  
22 plot" or "FFT plot," will you understand that I'm  
23 referring to the 2D FFT alignment plot that you've  
24 discussed in paragraph 39?

25 A. That would be labeled F in the figure.

1 Q. Right.

2 A. Okay. Yes.

3 Q. I just want to make sure if I say "FFT  
4 alignment plot" or "FFT plot" --

5 A. Yes.

6 Q. -- we're speaking the same language.

7 Do each of the three steps, high level  
8 steps in paragraph 39, involve additional  
9 substeps?

10 A. They can.

11 Q. Do they ever not?

12 A. Let's see. I'm -- I'm debating on how  
13 to answer that question.

14 In my laboratory, there would be other  
15 steps. In someone else's laboratory, I don't know  
16 if there are other steps.

17 Q. That's fair.

18 And my questions today are about, you  
19 know, your personal knowledge.

20 A. Uh-huh.

21 Q. So in your laboratory, for example, in  
22 step one, capturing data images, I assume -- is it  
23 fair to assume that, for example, you need to  
24 select which imaging modality to use, and you need  
25 to select the area of the image to be tested? Are

1 those accurate --

2 A. That's accurate.

3 Q. -- substeps? Okay.

4 So if I refer to the steps undertaken in  
5 your experience to perform FFT analysis, if I  
6 discuss that as, like, an FFT protocol, does that  
7 make sense?

8 A. Yes.

9 Q. Okay. Does the protocol for FFT  
10 analysis impact the validity of the results?

11 A. No.

12 Q. So if -- this would never happen in your  
13 laboratory, but if a flawed FFT protocol were  
14 applied, for example, somebody applied a mask that  
15 obscured all but a very small portion of the  
16 fibers, would that -- would those FFT results be  
17 valid and representative?

18 A. Not if the surface area was so small,  
19 you had one fiber in it. You could detect whether  
20 it was aligned, but not much else.

21 Q. So in that circumstance, the FFT  
22 protocol would impact the validity of the results,  
23 right?

24 MR. LEVINE: Objection to the form of  
25 the question.

1           THE WITNESS: I think that's so outside  
2           the bounds of the way the technique is used  
3           that it's -- it's not -- not something  
4           someone would do.

5           If it took a microscope image that was  
6           out of focus, it would affect the results to  
7           some degree.

8           If I erased half the fibers in the field  
9           and did an FFT, it wouldn't be valid.

10          Certainly, if you zoomed in on a single  
11          fiber and photographed the single fiber so  
12          you couldn't even see the edges of it, you  
13          couldn't even do an FFT.

14          There are parameters you have to meet on  
15          the image to make it useful for FFT.

16       BY MS. WIEKER:

17          Q.    So it sounds like there are certain  
18          circumstances where the FFT protocol would impact  
19          validity. Is that right?

20          MR. LEVINE: Objection to the form of  
21          the question.

22          THE WITNESS: In the examples that I  
23          just gave, yes.

24       BY MS. WIEKER:

25          Q.    In your opinion, what are the most

1 important -- what is the most important step in  
2 the FFT analysis?

3 A. The most important step? I think that  
4 the most important step is the primary data set,  
5 what is its composition, what kind of microscope's  
6 being used, because that dictates subsequent  
7 steps.

8 Q. And when you say "the primary data set,"  
9 are you referring to step one of paragraph 39,  
10 capturing data images?

11 A. Either using a data image that preexists  
12 or capturing one from your sample, yes.

13 Q. So obtaining the image is the most  
14 important --

15 A. Having the image, yes.

16 Q. Yes.

17 A. Because that tells you how to -- how to  
18 use that image.

19 Q. When performing FFT analysis, does a  
20 person of ordinary skill in the art typically  
21 document the steps they've taken?

22 A. Certainly for publication purposes, you  
23 do.

24 Q. Any other circumstance where a person of  
25 ordinary skill in the art would document the steps

1 they took?

2 A. Depending on the experiment and the --  
3 and the specific protocol you're using, if you're  
4 using a scanning electron micrograph or if you're  
5 using a bright-field microscope image, you would  
6 certainly document the parameters that you're  
7 using so you can reproduce them over and over and  
8 over and over and over again.

9 Q. Is reproducibility important?

10 A. It is within a study, and I would say  
11 within the bounds of a single publication, and  
12 leave it at that.

13 Q. Earlier this morning, we discussed your  
14 teaching experience at VCU, and I believe you  
15 indicated that you taught students regarding FFT  
16 analysis between approximately 2002 and 2019. Is  
17 that correct?

18 A. Yeah.

19 Q. When teaching and advising your  
20 students, do you recommend that they document  
21 their FFT protocol?

22 A. They must, because everything that a  
23 student ever did, I expected it to be publishable.

24 Q. And would you recommend that your  
25 students use a consistent FFT protocol across

1 samples that they're testing?

2 A. Not necessarily. If one student was  
3 working with a bright-field image, they might have  
4 a slightly different protocol than someone who was  
5 doing a scanning electron micrograph.

6 Q. Okay. In paragraph 39, the first FFT  
7 analysis step you identify is, quote: Capturing  
8 data images of electrospun scaffolds using a  
9 microscope.

10 A. Yes.

11 Q. Does the quality of that image used for  
12 FFT analysis impact the results?

13 A. Certainly, but the technique is pretty  
14 forgiving. And so even an imperfect image can  
15 often be used.

16 Q. I'm going to jump ahead a little bit in  
17 that same exhibit to page 79, paragraph 184. Can  
18 you let me know when you're there?

19 A. I'm there.

20 Q. Okay. Could you read the paragraph  
21 that -- I'm sorry. The -- this -- could you read  
22 the sentence that begins under the figures that  
23 you've copied into paragraph 184?

24 A. I used the images -- is that where  
25 I'm -- am I in the right place?

1 Q. Uh-huh.

2 A. I used the images from Lee's provisional  
3 patent application for my analysis because they  
4 are the same subject matter as the images in Lee,  
5 but they are higher quality images.

6 The scaffold in -- oh, you said first  
7 sentence. I'm sorry.

8 Q. Yeah. That's fine. Thank you.

9 What did you mean there by "higher  
10 quality images"?

11 A. There's more information in this image,  
12 the Xerox copy in the -- I guess it's in the  
13 actual Lee patent; looks like it's been Xeroxed a  
14 hundred times and you can only see a few black and  
15 white dots. In this image, I can see fibers.  
16 More importantly, I can see edges.

17 Q. So you agree that the higher the quality  
18 of the image, the more accurate are the results of  
19 the FFT alignment plot; is that correct?

20 A. You know --

21 MR. LEVINE: Objection to the form of  
22 the question.

23 You can answer.

24 BY MS. WIEKER:

25 Q. You can answer.

1           A.    No, I don't agree with that.

2           Q.    Okay.  Then let's -- let's stick with  
3 paragraph 184.

4                   Why did you not use the image in the Lee  
5 patent itself?

6           A.    Because it's almost -- there's almost no  
7 information in it.  It's largely just a big empty  
8 black space with a few white lines in it, hardly  
9 representative of this data image.

10          Q.    So had you performed FFT analysis with  
11 an image of the quality you're describing from the  
12 Lee patent --

13          A.    No.

14          Q.    Sorry.  Let me ask the question this  
15 way.

16                   If you had performed FFT analysis with  
17 an image of the quality of that Lee patent that  
18 you're describing, would you have accuracy in the  
19 results obtained?

20          A.    I think that's unlikely because there's  
21 not enough information to develop -- FFT looks at  
22 edges.

23          Q.    Uh-huh.

24          A.    And there just aren't, as I recall --  
25 I'm going to -- could I look at that picture?

1 Q. Yeah. We'll turn to it later. I'm just  
2 trying to understand --

3 A. Okay.

4 Q. -- the broader position you're taking  
5 here.

6 A. If you have a single fiber and you do an  
7 FFT, you can get an alignment plot for that single  
8 fiber, but it's hardly representative of a  
9 scaffold that has maybe thousands of fibers in an  
10 image. So you can get an alignment output from  
11 those kinds of images with just a single fiber,  
12 but they're relatively meaningless.

13 Q. Okay. So --

14 A. The power of FFT is it samples a  
15 population of fibers --

16 Q. Uh-huh.

17 A. -- a large population of fibers.

18 Q. So do you agree that if the image is  
19 sufficiently poor quality, then the FFT -- the FFT  
20 alignment plot is unreliable?

21 A. The -- certainly doing an FFT on the Lee  
22 patent image would be suspect. I would have to  
23 see the results.

24 Q. So I'd like, to the extent you can, a  
25 yes-or-no answer.

1           Do you agree that if an image is of  
2           sufficiently poor quality, then the FFT alignment  
3           plot is unreliable?

4           MR. LEVINE: Objection to the form.  
5           Asked and answered.

6           THE WITNESS: If it's -- yes.

7           BY MS. WIEKER:

8           Q.    When considering the image, do you agree  
9           that the resolving power of the equipment used for  
10          image capture impacts image quality?

11          A.    I do.

12          Q.    Would the resolving power also impact  
13          the resulting FFT plot?

14          A.    Theoretically, higher resolution allows  
15          the detection of increasingly smaller fibers.

16                I don't think that would change the  
17          results. If the scaffolds align, the scaffolds  
18          align for the most part.

19          Q.    And is it your view that the real power  
20          of FFT analysis is in detecting a large amount of  
21          fibers?

22          A.    Surveying a field of fib -- the strength  
23          is the ability to nondestructively evaluate the  
24          degree of alignment in a field of fibers.

25          Q.    So then is it important to detect as

1 many fibers as possible in that field?

2 MR. LEVINE: Objection to the form of  
3 the question.

4 THE WITNESS: Well, again, one fiber,  
5 you can do an FFT plot on it and you'll get a  
6 two peak plot. If you have two fibers,  
7 you'll get the same results.

8 It's the orientation of the object in  
9 the image that gives you the plot.

10 It's the number of fibers that gives you  
11 the confidence to determine whether the  
12 scaffold is aligned or not.

13 BY MS. WIEKER:

14 Q. In an FFT analysis, would a person of  
15 ordinary skill in the art seek to obtain more or  
16 fewer fibers for that analysis?

17 MR. LEVINE: Objection to the form of  
18 the question.

19 MS. WIEKER: I'll rephrase.

20 BY MS. WIEKER:

21 Q. In an FFT analysis, would a person of  
22 ordinary skill in the art seek to obtain more  
23 fibers for that analysis?

24 MR. LEVINE: Objection to the form of  
25 the question.

1 THE WITNESS: I -- I -- I don't know how  
2 to answer.

3 BY MS. WIEKER:

4 Q. In an FFT analysis, would a person of  
5 ordinary skill in the art seek to obtain many  
6 fibers in their image?

7 A. I think that's certainly more desirable  
8 because the -- the system is designed to look at  
9 populations.

10 Q. Thank you.

11 Do you agree that the amount of surface  
12 area that is captured in an image impacts the  
13 results of FFT testing?

14 A. It does not. I -- wait. Wait. Let  
15 me -- let me rephrase that slightly.

16 Surface area in a microscopic image is  
17 dependent on magnification. And if you zoomed in  
18 so there's only one -- so you're only seeing the  
19 inside of a fiber and nothing else, that would  
20 affect the results. If you zoomed way out where  
21 you couldn't even see the individual fibers, that  
22 would affect the results. And I'll leave it at  
23 that.

24 Q. Is it fair to say that in identifying  
25 the area of the image upon which you're running

1 your FFT analysis, that that area should be  
2 representative of the scaffold at large?

3 A. Yes. And that's usually achieved by  
4 sampling the scaffold in several places.

5 Q. Okay. Do you agree that the manner in  
6 which images are stored impacts image quality?

7 A. I do.

8 Q. To what extent?

9 A. In a JPEG file which can be compressed,  
10 there can be a degradation in the --

11 Q. Uh-huh.

12 A. -- resolution of the fibers, resolution  
13 of things, because you are reducing file size.

14 In order to see something like that, you  
15 probably have to open and close the file several  
16 thousand times or more than several thousand  
17 times.

18 It's theoretically possible to degrade  
19 it if you open and close it enough if it's a  
20 certain file type.

21 Q. Is sample illumination important in  
22 capturing the data image?

23 A. It is. And it -- that's, again,  
24 generically, that's true. It's more true for a  
25 bright-field image than an -- than an electron

1 micrograph. It's important for both, but for  
2 different reasons.

3 Q. And why is it important for a  
4 bright-field image?

5 A. If the light intensity is very high, you  
6 won't be able to see any fibers. If -- same thing  
7 with low intensity.

8 And if the illumination is not set  
9 properly, it will -- it will -- it will make it  
10 difficult to normalize an FFT plot.

11 Q. And in what way is it important for an  
12 electron micrograph image?

13 A. It is possible to have too much  
14 information. The FFT looks for edges. And if you  
15 start to set the microscope up so that you're  
16 seeing a lot of substructure in the fibers, some  
17 fibers will have wrinkles in it, if those wrinkles  
18 show up on the micrograph, they can be viewed as a  
19 fiber edge.

20 Q. Okay. And when you used the term  
21 "electron micrograph," is that the same as a  
22 scanning electron microscope?

23 A. Yes.

24 Q. Okay. And if we refer to scanning  
25 electron microscope as "SEM," does that make

1 sense?

2 A. Yes.

3 Q. Okay. If the scaffold that you're  
4 analyzing with FFT analysis has multiple layers,  
5 would that impact the FFT results?

6 A. If they're all random or they're all  
7 aligned as -- depending on the microscope that  
8 you're using, it wouldn't.

9 Q. If the layers differ in alignment  
10 orientation?

11 A. I would expect there to be a difference,  
12 yes.

13 Q. And how would the -- how would that  
14 difference appear in the results?

15 A. It would depend on how aligned and  
16 how -- how much it was aligned and how much of it  
17 is random.

18 Q. Would the FFT plot differ for a scaffold  
19 that has distinct layers with differing alignment  
20 orientations?

21 MR. LEVINE: Objection to the form of  
22 the question.

23 THE WITNESS: In an SEM, it wouldn't  
24 make any difference because you're only  
25 looking at the surface.

1 BY MS. WIEKER:

2 Q. Okay. And what about with confocal  
3 microscopy?

4 A. That samples individual optical layers,  
5 and so you would be able to do a FFT on the  
6 surface of the sample, and for a short distance  
7 into it, it tends to be -- well, tends to not go  
8 that deep into those scaffolds in my experience.

9 But if you had an aligned scaffold spun  
10 onto a random scaffold, as long as the aligned  
11 scaffold was thin enough to allow the microscope  
12 to penetrate to the random scaffold, you'd get a  
13 different FFT.

14 Q. So let's talk a little bit about  
15 different imaging modalities.

16 I think so far, you've mentioned  
17 bright-field imaging, you just discussed confocal  
18 microscopy, and scanning electron microscopy. Is  
19 that correct?

20 A. Yes.

21 Q. Are there any other imaging modalities  
22 that are commonly used to obtain the image for FFT  
23 analysis?

24 A. There are some other forms of light  
25 microscopic evaluation that could possibly be

1 used, certainly.

2 And it would be challenging, but you  
3 might be able to do transmission electron  
4 microscopy. But I'd reserve judgment on that.  
5 That would be very challenging.

6 Q. Okay. Is it fair to say that the three  
7 we identified, bright-field, confocal, and SEM,  
8 are the most common mechanisms?

9 A. I -- well, I -- I don't know if that's  
10 true in the literature. That's what I did.

11 Q. Okay. In your experience then, those  
12 are the -- the big three, bright-field, confocal,  
13 SEM?

14 A. In my laboratory, yes.

15 Q. Okay. Thank you.

16 Just to be sure I understand your  
17 testimony from a moment ago about analyzing a  
18 scaffold with multiple layers, is it your view  
19 that the FFT alignment plot would vary when  
20 analyzing a scaffold with distinct layers with  
21 confocal microscopy as compared to SEM?

22 A. Yes.

23 Q. Okay. And is that because the confocal  
24 will detect some of the lower layers of the  
25 scaffold that are not detected by the SEM?

1 A. Yes.

2 Q. Okay. Are there any disadvantages to  
3 using SEM?

4 A. There are. It samples an incredibly  
5 small, tiny area of what is potentially a large  
6 scaffold -- I mean a large surface area scaffold.  
7 And it's destructive.

8 Q. When you say, "it samples an incredibly  
9 small tiny area," are you talking depth of the  
10 scaffold or surface?

11 A. Surface area.

12 Q. Surface area, okay.

13 Any disadvantages with SEM as to the  
14 depth that it analyzes?

15 A. It's just probably -- I -- I don't want  
16 to use the word "layer" because that's not the  
17 right word.

18 There are dis -- it probably images  
19 the -- the surface certainly is what it images.  
20 And you can imagine a fiber lying on top of  
21 another one, a fiber -- those two fibers lying on  
22 top of another fiber, that's about the depth you  
23 get depending on the fiber size.

24 Q. Okay.

25 A. So it's not really a layer, but it's

1 in -- a little bit into the scaffold.

2 Q. Is it fair to say a shallow --

3 A. Well, I'd say, like --

4 Q. -- imaging?

5 A. I -- I would prefer to say, like, three  
6 to four fibers deep.

7 Q. Okay. Are there any limitations to  
8 using bright-field imaging?

9 A. There are.

10 Q. What are those?

11 A. The microscope has to be properly set up  
12 to provide even illumination across the sample.

13 The sample can't be so thick as to not  
14 allow light to go through it.

15 To some extent, it also suffers from the  
16 same limitation as sampling a scaffold with SEM in  
17 the sense that you can imagine a scaffold composed  
18 of fibers of some size, and you use a low  
19 magnification objective to photograph the largest  
20 surface area you could possibly get, but if the --  
21 if the resolution of that low magnification  
22 objective can't capture the images, you're just  
23 going to get shadows.

24 At the other extreme, if the objective  
25 is too big, then -- and I -- I'm guessing the 100

1 X objective, if it's too big, then you're --  
2 you're -- you're back to the same problem with  
3 SEM, you're sampling a very small area.

4 Q. Can bright-field microscopy be  
5 successfully used to image discrete fiber layers?

6 MR. LEVINE: Objection to the form of  
7 the question.

8 THE WITNESS: Technically. Technically,  
9 confocal microscopy is light microscopy, even  
10 though it uses a laser. It can image at  
11 least partway into a scaffold. And when we  
12 --

13 BY MS. WIEKER:

14 Q. Have you --

15 A. And when we talk about imaging, it's  
16 important, I think, to note that it's -- it's the  
17 material -- I'm having a middle-age moment.

18 You could, theoretically, image maybe a  
19 fiber deep and -- in a -- in a scaffold with a  
20 light microscope, depending on the objective.

21 And when I say "a fiber deep" or "two  
22 fibers deep," something like that, I mean you  
23 could actually see the fiber, not a shadow of a  
24 fiber, but actually be able to see that, "Oh,  
25 that's a fiber," not a thread or a piece of

1 contaminant. But beyond that, you're really not  
2 going to see very much.

3 Q. Have you ever used bright-field imaging  
4 to perform FFT analysis of a scaffold with  
5 discrete layers?

6 A. No.

7 Q. Okay. Do you agree that using SEM  
8 imaging requires a uniform distribution of fibers  
9 throughout the scaffold?

10 A. It requires the assumption that the site  
11 that you're sampling reflects the greater  
12 scaffold.

13 Q. And if there is not a uniform  
14 distribution of fibers, contrary to your  
15 assumption, how would that affect the resulting  
16 FFT alignment plot?

17 A. On any one picture, it wouldn't change  
18 it at all. You could sample the scaffold over and  
19 over, and until you had sampled a -- you know,  
20 some statistically significant number of sites,  
21 you wouldn't know until after you were done if  
22 there was a difference between one area and  
23 another. But it wouldn't change how any one FFT  
24 analysis was done on one microscope field.

25 Q. Would sampling on one microscope field

1 be representative of fiber alignment if there is  
2 not a uniform distribution of fibers?

3 A. No.

4 Q. Okay.

5 A. That's the assumption.

6 Q. Okay. Okay. Your declaration, I think  
7 we were on paragraph 39.

8 39 states that: The second high level  
9 step of FFT analysis is "Applying the 2D FFT  
10 method to create a 2D FFT output image."

11 A. Yes.

12 Q. How do you do that?

13 A. Well, there are a series of steps to  
14 accomplishing that, as outlined in Ayres.

15 Q. Which Ayres?

16 A. I think in both it pretty well documents  
17 how to get through that step.

18 Q. On the same paragraph of your  
19 declaration, you state that the third step is to  
20 process the FFT output to create a 2D alignment  
21 plot.

22 Is that right?

23 A. Yes.

24 Q. How is that done?

25 A. In ImageJ, after you have -- after you

1 have done the oval -- or, I'm sorry, the radial  
2 summation step, you export the information present  
3 in that summation -- export's not quite the right  
4 word there.

5           You actual -- the program will give you  
6 what amounts to a very rudimentary Excel  
7 spreadsheet-like piece of data, and I think it  
8 goes from -- I think it's numbered from zero to  
9 360, because that's how many -- how many degrees  
10 are in the circle, in the oval that it's measured  
11 the radial sums from, and it puts the pixel  
12 summation value for each degree adjacent to the  
13 number or the degree that it was reported from  
14 like 10 degrees, 50 pixels, 30 degrees, a hundred  
15 pixels, and then that information can be retrieved  
16 and put into an Excel spreadsheet for further  
17 analysis.

18       Q.   And in your answer, you referred to the  
19 radial summation step.

20       A.   Uh-huh.

21       Q.   Is that part of generating the FFT  
22 output image or generating the alignment plot?

23       A.   I -- I'm sorry. Would you do that  
24 again? I'm sorry.

25       Q.   Of course.

1       A.    I was too busy reading.

2       Q.    In your answer, you said -- you  
3   referenced a radial summation --

4       A.    Yes.

5       Q.    -- step. I'm trying to figure out if  
6   that's part of step two in the paragraph 39 or  
7   step three.

8       A.    I would say that that is somewhere in  
9   between those two.

10      Q.    Okay.

11      A.    And I'd like to make one addition and  
12   note that the ImageJ program is fully capable of  
13   producing the output alignment plot. I just find  
14   it easier to plot things in other programs. But  
15   it is capable of doing it in that program. It's  
16   just very --

17      Q.    So you don't have to retrieve the  
18   data --

19      A.    You --

20      Q.    -- from this Excel site --

21      A.    You don't.

22      Q.    -- and -- and plot it itself?

23      A.    No. No. We would archive all that  
24   information.

25      Q.    Okay. All right.

1 MR. LEVINE: Dr. Simpson, I'm just  
2 looking at the record. Try to wait for the  
3 question before you answer it because --

4 THE WITNESS: Yes, sir.

5 MR. LEVINE: -- there are a bunch of  
6 "nos" in the between the -- the question  
7 that's being asked.

8 MS. WIEKER: All right. I think we're  
9 on to Exhibit 4 to be marked now.

10 THE WITNESS: Now can we take a short  
11 break so I can pee?

12 MS. WIEKER: Of course. Any time --

13 THE WITNESS: Just -- just a short one.

14 MS. WIEKER: Yeah. I'll be here when  
15 you get back.

16 THE WITNESS: I will -- I will not be  
17 comfortable.

18 THE VIDEOGRAPHER: The time is  
19 11:04 a.m., we are now off the record.

20 (Recess taken at 11:04 a.m., proceedings  
21 resumed at 11:11 a.m.)

22 THE VIDEOGRAPHER: The time is  
23 11:11 a.m., we're now on the record.

24 MS. WIEKER: I'd like to introduce an  
25 exhibit into the record as Exhibit 4.

1 (Simpson Deposition Exhibit 4 marked for  
2 identification.)

3 THE WITNESS: Thank you.

4 BY MS. WIEKER:

5 Q. Dr. Simpson, do you recognize this  
6 document?

7 A. Yes, I do.

8 Q. Are you listed as an author on this  
9 paper?

10 A. I am.

11 Q. Will you consider this paper to be a  
12 reliable source of information for a person of  
13 ordinary skill in the art?

14 A. I do, certainly for the time it was  
15 published.

16 Q. And is this paper cited in your  
17 declarations as Exhibit 1003 -- I'm sorry. It's  
18 cited, your declaration -- I'm sorry, strike that.  
19 I've got my numbers mixed up.

20 Is this paper cited in your  
21 declarations?

22 A. Yes, I see it there. It's 1013. Now  
23 I'm looking at '223.

24 Q. Would you turn to page 608, please.

25 A. Okay. I'm there now.

1 Q. And before we do that, just to confirm  
2 the record, could you turn to Exhibit 1, your IPR  
3 ' '248 Declaration.

4 A. Yes.

5 Q. According to Appendix A at the back, the  
6 publication I just gave you marked as Exhibit 4,  
7 "Measuring fiber alignment in electrospun  
8 scaffolds: A user's guide to the 2D fast Fourier  
9 transform approach," this is Exhibit 1010 --

10 A. Oh, it is.

11 Q. -- in that version, is that right?

12 A. It -- it is 1010. Yes.

13 Q. Okay. I just want to make sure.

14 A. Yes. Yes.

15 Q. Yes.

16 A. I see that.

17 Q. Okay. All right. So now could you  
18 please turn to page 608 of what is marked as  
19 Exhibit 4. The page is titled Results, and has an  
20 overview of the 2D FFT function.

21 In our earlier discussion, when I asked  
22 about how you create a 2D FFT output image, you  
23 indicated that that was discussed in the Ayres  
24 paper.

25 Can you show me where in what's marked

1 as Exhibit 3 -- what's marked as Exhibit 4, I'm  
2 sorry, that process is discussed?

3 A. Most of the entire paper is process. It  
4 was a book chapter explaining how to use the  
5 technique and where to use the technique.

6 Q. Right. And I'm asking about the  
7 specific step of generating the 2D output image.

8 A. Ah. Okay.

9 I think that is substantially covered on  
10 page 609.

11 Q. Okay. Could you read -- read what  
12 portion you're referencing?

13 A. Processing a bright-field data image by  
14 2D FFT produces -- produces a frequency plot or  
15 power spectrum. This plot is composed of  
16 grayscale pixels that are distributed into a  
17 pattern that can be used to measure the degree of  
18 fiber alignment present in an original data image.  
19 The frequency plot produced by NIH ImageJ software  
20 places low frequency pixels at the origin or  
21 center of the frequency plot.

22 There's parentheses there, and it says:  
23 Note, selective iterations of the FFT function  
24 invert this convention and place low frequency  
25 pixels at the image periphery, close parentheses.

1           Low frequency signals correspond to  
2 domains within the original micro -- microscopy  
3 image that contain pixels of similar values.  
4 Adjacent pixels do not vary to any great -- do not  
5 vary to a great extent in intensity. The bulk of  
6 this information originates with the background  
7 and overall shape of the image. High frequency  
8 pixels are placed away from the origin and toward  
9 the periphery of the frequency plot. This  
10 information corresponds to spatial domains that  
11 exhibit abrupt changes in pixel and density.  
12 Edges, details, and noise in the data image all  
13 contribute to the generation of high frequency  
14 pixels. When an image of random fibers is  
15 processed by 2D FFT, the resulting frequency plot  
16 contains a cluster of white pixels that are  
17 concentrated in a symmetrical circular pattern.

18           Now -- where was it, I lost my place.

19 "At this point" --

20       Q.    Dr. Simpson --

21       A.    So -- yeah?

22       Q.    -- would you please let me know which  
23 portion of that paragraph you just read relates to  
24 the 2D FFT image, the steps --

25       A.    Well, that's the production of the --

1 what's called the frequency plot. There's a tab  
2 in the software that says --

3 Q. Uh-huh.

4 A. -- "Produce FFT," and you push that tab  
5 and it puts it out.

6 Q. So if we turn back to page 608, the  
7 Images 1-B, 1-E, and 1-H, are those the output  
8 images?

9 A. B, E, and H, those are the frequency  
10 spectrum.

11 Q. Do you have reproduced here the FFT  
12 output images anywhere?

13 A. These are the FFT output images.

14 Q. Oh. Okay.

15 A. I'm sorry.

16 Q. So, like -- that's okay.

17 A. That was confusing.

18 Q. So let me just ask the question one more  
19 time for clarity.

20 On page 608, Images 1-B, 1-E, and 1-H,  
21 are those the FFT output images?

22 A. Yes.

23 Q. Okay. Thank you.

24 And is it correct that when moving from  
25 those images to the FFT plot, you apply a circular

1 projection tool to the output image?

2 A. Yes.

3 Q. How do you apply that tool?

4 A. There is, in the menu of ImageJ, an  
5 oval, and you -- if you select that as your  
6 cursor, you apply the circle as depicted in B to  
7 the output image, and -- and you're done.

8 Q. How do you determine the shape or size  
9 of the circle that you're applying through that  
10 tool?

11 A. In my laboratory, there was no deciding;  
12 it was based on what you see here, that the edges  
13 of the circle would be tangential to the edges of  
14 the -- of the output image.

15 Q. Okay. Thank you.

16 All right. Staying with that same page,  
17 608, are Figures 1-C, 1-F, and 1-I examples of FFT  
18 alignment plots?

19 A. Yes.

20 Q. Does an FFT alignment plot reflect  
21 information about the fibers in the image that was  
22 analyzed?

23 A. Yes.

24 Q. In what way?

25 A. Well, this is the -- this is -- on the

1 x-axis is the angle of acquisition for the sum  
2 pixels.

3 For example, in Panel B, has a radian  
4 from the center of the circle to the edge of the  
5 circle, and so at zero degrees on the plot, that  
6 represents the pixel summation along that radian.  
7 And that goes on for each degree that radian --  
8 that radial summation.

9 The y-axis represents arbitrary units of  
10 alignment.

11 Q. And how do -- start over.

12 Do the pixels' intensity reflected in  
13 the FFT plot correspond to the fibers?

14 MR. LEVINE: Objection to the form.

15 THE WITNESS: There are -- there are a  
16 map of frequencies that are present in the --  
17 in the data image that the plot came from.  
18 They essentially map the frequency at which a  
19 particular pixel occurs along some  
20 orientation.

21 So it is representative of the fibers in  
22 that perspective, or the -- the pixels that  
23 make it's -- representative of the pixels  
24 that make up the image.

25

1 BY MS. WIEKER:

2 Q. Okay. Are you familiar with the term  
3 "major peaks" in the context of a 2D FFT alignment  
4 plot?

5 A. I am.

6 Q. And how would you describe major peaks?

7 A. In Panel C, F, and I, notice that the  
8 trace has a little bit of wiggle to it, there are  
9 some ups and downs in the trace.

10 And at approximately -- looks like about  
11 at approximately 90 degrees in C is a peak.

12 I would not refer to that as a major  
13 peak because all the peaks in that particular plot  
14 look like they're essentially very similar in  
15 height.

16 A major peak is evident in F, in that  
17 the peak that is present at about 180 degrees or  
18 so is very small.

19 And there are adjacent peaks on either  
20 side of it, which are probably on the order of two  
21 and a half times taller. And the same description  
22 holds true for the final plot, where the major  
23 peaks are higher than the other peaks that are  
24 present in -- in the plot.

25 Q. So in describing Figures 1-F and 1-I,

1 you referenced the taller peaks as major peaks?

2 A. Yes.

3 Q. Would another way to describe a major  
4 peak be that its height is higher than the average  
5 heights of the peaks in the plot?

6 A. If a user so desired, yes.

7 Q. So in this context, is major or taller,  
8 as you described it, are those relative terms?

9 A. Yes.

10 Q. Okay. All right. Let's turn to page  
11 610, please.

12 In the second full paragraph, the  
13 paragraph starts with "Specific degrees of  
14 alignment."

15 You state in that paragraph: Specific  
16 degrees of alignment can be correlated with the  
17 onset of distinctive material properties.

18 A. Yes.

19 Q. You identify what you called a threshold  
20 alignment value of 0.05 units.

21 A. Yes.

22 Q. What scale is that 0.05 units reported  
23 on?

24 A. That is alignment plot on Figure 1.

25 Q. And is that 0.05 -- is that an arbitrary

1 number that corresponds only to the scale shown in  
2 Figure 1, or is that transferrable?

3 A. I would be uncomfortable saying that you  
4 could apply that rule to every scaffold you looked  
5 at because it would depend on how the image was  
6 captured, it would depend on how bright, how dark  
7 it was, how much background subtraction had to be  
8 taken down.

9 You can certainly apply that scale  
10 across different scaffolds, like we did in  
11 Figure 1 in this manuscript, but we had calibrated  
12 the techniques over repeatedly using exactly the  
13 same lighting conditions for everything.

14 So within that, it is transferrable.

15 Q. And what are the anisotropic properties  
16 that you refer to in this paragraph that are  
17 correlated with hitting that threshold,  
18 0.05 units?

19 A. It's mostly stress.

20 Q. Uh-huh.

21 A. For this particular sample.

22 Q. Okay. Turning back to the first  
23 paragraph on page 610.

24 About midway through the paragraph, you  
25 state: The degree of alignment present in the

1 original data image is reflected by the height and  
2 overall shape of the most prominent peaks present  
3 in the alignment plot.

4 A. I see that.

5 Q. Okay. Let's break that apart.

6 What does the height of the most  
7 prominent peaks convey about the degree of  
8 alignment?

9 A. The peak of the peaks, the height of the  
10 peak is reporting the principal angle of  
11 alignment.

12 Q. Is that the same as the principal axis?

13 A. Yes.

14 Q. Okay. Can I turn you, then, to  
15 page 608.

16 A. Okay.

17 Q. At the very bottom in the caption, the  
18 last sentence of the caption, it says: The peak  
19 position reports the principal axis of  
20 orientation.

21 A. Yes.

22 Q. So is it the peak position or the peak  
23 height that represents the principal axis of  
24 orientation?

25 A. The peak position reports the principal

1 axis. The peak height reports the relative degree  
2 of alignment.

3 Q. So a minute ago you said the height of  
4 the peak is reporting the principal angle of  
5 alignment.

6 A. The principal -- it's the peak of the  
7 principal peak that is telling you the -- the  
8 principal axis of alignment. That is independent  
9 of the height of the peak.

10 For example, in Panel F, there is some  
11 apparent anisotropy in the sample.

12 There is a higher peak in I, indicating  
13 anisotropy, you know, the -- the background noise  
14 depicted by the small peak in the middle hasn't  
15 changed a lot.

16 The position of where that peak is the  
17 highest for those principal peaks represents the  
18 angle in which the fibers are oriented.

19 Q. So when I -- earlier I said: What does  
20 the height of the most prominent peak convey about  
21 the degree of alignment?

22 And your answer was: The height of the  
23 peak is reporting the principal angle of  
24 alignment.

25 A. It -- that is true. And it is also --

1 the height of that peak reports the degree of  
2 alignment, also.

3 I see where you -- I see the confusion.

4 Q. So in the caption on page 608 where it  
5 says, "The peak position reports the principal  
6 axis," is that incorrect?

7 It should say, "The peak height"?

8 A. No. The peak -- it's the position of  
9 the peak of the principal -- the -- the -- too  
10 many peaks.

11 The position of the highest point of the  
12 principal peaks reports the bulk of alignment  
13 present in a sample.

14 Q. Okay. So when -- please tell me if this  
15 is correct or incorrect.

16 In that caption, when you say "peak  
17 position," that really means the highest peak --  
18 basically, the y-axis value of the highest peak is  
19 what you're referring to as "position"?

20 A. No. You're referring -- it refers to  
21 the -- if you drop a line from the tallest part of  
22 the peak, say, in Panel I, to the x-axis, that is  
23 the position --

24 Q. Okay.

25 A. -- that reports the angle of

1 orientation.

2 Q. So position on x-axis reflects the  
3 principal orientation -- principal axis  
4 orientation?

5 A. Yes.

6 Q. And then what is the Y value of the  
7 highest peak telling us?

8 A. Within this series of three images, the  
9 height of those peaks is reporting an increasing  
10 amount of alignment as we transition from C to F  
11 and F to I.

12 Q. So that's what you refer to in the paper  
13 as "the degree of alignment"?

14 A. Yes.

15 Q. Okay. Thank you.

16 All right. In that sentence I read  
17 earlier, it said: The degree of alignment present  
18 in the original data images reflected by the  
19 height and overall shape of the most prominent  
20 peaks.

21 So what does the shape tell us?

22 A. The shape, again, is a trace of the  
23 pixel summation, and it's reporting on a  
24 pixel-by-pixel value what's present in an image.

25 It raster scans the entire image and

1 evaluates the relationship of pixels that are  
2 adjacent to one another. And the radial summation  
3 is, as we talked about, taking the frequency plot  
4 and summing the pixels along each radian.

5 And those peaks represent the number of  
6 pixels that are reported to be in a particular  
7 orientation in the image.

8 A very tall, sharp peak, if you had a  
9 single fiber, there's only -- there's only one  
10 orientation in the image would produce a very tall  
11 thin peak because there's no adjacent pixels.  
12 There's -- there's -- there's no -- there's no  
13 deviation from the -- the -- the fiber doesn't  
14 deviate from its orientation, I guess that's the  
15 best way to say it.

16 Q. Uh-huh.

17 A. If I put a second fiber on and I tilted  
18 it slightly, then we would start to begin to add  
19 pixels that are now no longer perfectly aligned  
20 with the first fiber, and when we did a radial  
21 summation of that, as more and more fibers are not  
22 going in the same direction, the peak, at first,  
23 might get broader, and then it will start to  
24 shrink.

25 So a high, sharp peak indicates that

1 there may be, you know, a very strong principal  
2 direction of orientation.

3 Q. Okay. Thank you.

4 So also on page 610, you say: A high  
5 and narrow peak indicates a more uniform degree of  
6 fiber alignment. A broad peak or a shoulder on  
7 the peak indicates that more than one axis of  
8 alignment may -- may be present.

9 Is that correct?

10 A. That's true.

11 Q. Okay. So I want to dig into each of  
12 these -- these three shapes.

13 All right. So I'm going to ask you to  
14 do your best to draw certain of these shapes that  
15 I will then ask Ms. Ribaric to mark as exhibits.  
16 Can I hand this to you, please?

17 MS. WIEKER: And, Howard, if you'd like  
18 just to have -- they're just blank, but...

19 BY MS. WIEKER:

20 Q. So I'd like to know what you mean by a  
21 high and narrow peak. So on that sheet I've given  
22 you -- do you have a pen?

23 A. I do not.

24 Q. Okay.

25 A. Not -- oh, there's a -- I was going to

1 say, there's a bucket of them there. Thank you.

2 Q. I'll get you --

3 A. I think that might be better.

4 Q. On top of that paper, could you please  
5 write "high and narrow peak"?

6 A. (Witness complies.)

7 Q. And if it's needed, feel free to add  
8 values for the x -- the y-axis, but I'd like you  
9 to please draw a high and narrow peak.

10 A. The --

11 MR. LEVINE: I'm -- I'm just going to  
12 object as an incomplete hypothetical without  
13 values, axes, anything.

14 But go ahead, Dr. Simpson.

15 BY MS. WIEKER:

16 Q. Well, why don't we -- Dr. Simpson, you  
17 used the language "high and narrow peak" in your  
18 paper, and in your paper you have y-axis values  
19 going up to 0.12.

20 A. High and narrow peak is imaged in --  
21 sorry, I got to find that figure.

22 The peaks in C represent the background  
23 degree of information that's present in the image.

24 In other words, there's just this --  
25 it -- it's just mapping composition of the image.

1 There's no alignment, so the peaks are short. And  
2 in this particular experiment, when we ran the  
3 FFT, the peaks in F and I were much higher than  
4 those background values, and so those are high  
5 peaks, they're above the background.

6 And the background is -- is depicted as  
7 the small peak in each of the images -- or each of  
8 the plots that are present there in F and I.

9 I would say observationally that the  
10 width of the peak in I looks to be more narrow  
11 than the peak in F.

12 And if I look at the Panel D, and I look  
13 at the Panel G, subjectively, there appears to be  
14 more things in alignment from D to G, as reported  
15 in those -- the position of the peaks for  
16 determining -- the angle of alignment and the  
17 shape of the peaks determining the degree of  
18 alignment.

19 Q. Dr. Simpson, in page 610, you use the  
20 phrase, "A high and narrow peak."

21 I'd like you to either identify whether  
22 one of the plots, Figure 1-C, 1-F or 1-I, which of  
23 those are high and narrow, and if none of those  
24 are high and narrow, I'd like you to please draw  
25 that on the plot you've been given, subject to

1 Mr. Levine's objection.

2 A. I think that I would call Panel I as  
3 high and narrow.

4 Q. Okay.

5 A. Compared to Panel C. It's a relative  
6 description between those two samples that I know  
7 were captured and processed at the same time.

8 Q. Okay. Now, what do you mean by "broad  
9 peak"? "Broad peak"?

10 A. A broad --

11 Q. Is that -- is that reflected in one  
12 of --

13 A. No --

14 Q. -- these figures?

15 A. -- it is not.

16 A broad peak -- a broad peak is a  
17 rounded peak, almost -- I'm exaggerating when I  
18 say, like, a plateau. But you can't discern a  
19 specific angle that represents the highest degree  
20 of alignment because the rounded nature of the  
21 peak -- the rounded nature of the peak makes it  
22 difficult to discern where to drop the line to the  
23 x-axis to determine the angle of orientation.

24 Q. And that is not shown in Figure 1-C, 1-F  
25 or 1-I?

1 A. No.

2 Q. Okay. I'd like to give you a blank  
3 plot. And would you please write "broad peak" on  
4 the top?

5 A. (Witness complies.)

6 Q. And if it bears on your view of what a  
7 broad peak is, please add the y-axis values that  
8 would be appropriate.

9 A. That's totally arbitrary. It doesn't  
10 matter what that -- what it is.

11 Q. Okay. And could you please draw a broad  
12 peak?

13 A. It's only broad relative to a peak that  
14 is -- that it could be compared to. So I have to  
15 draw two peaks in order to draw a draw -- a broad  
16 peak.

17 Q. Okay.

18 MR. LEVINE: I object -- I object,  
19 again, as an incomplete hypothetical.

20 But go ahead, if you can.

21 THE WITNESS: I'm going to use that as a  
22 model.

23 (Witness complies.)

24 MS. WIEKER: Okay. Ms. Ribaric, let's  
25 mark that, please, as Exhibit 5.

1 (Simpson Deposition Exhibit 5 marked for  
2 identification.)

3 BY MS. WIEKER:

4 Q. And, Dr. Simpson, just to make sure I  
5 understand your testimony, on page 610 when you  
6 refer to a "broad peak," you testified that's a  
7 relative term. So that is something broader than  
8 a high and narrow peak in an FFT plot; is that  
9 correct?

10 A. Doesn't have to be.

11 Q. Okay. Then please tell me what a broad  
12 peak is.

13 A. A broad peak is one that is -- it's  
14 wider than a narrow peak. I mean, I -- I don't  
15 know how -- I don't know how to put a objective  
16 number on -- onto a subjective concept here.

17 Q. Then let me -- let me repeat my  
18 question.

19 So is a broad peak something broader  
20 than a high and narrow peak in an FFT plot, and  
21 you said it doesn't have to be?

22 A. Doesn't --

23 Q. So --

24 A. -- have to be. No, it doesn't. Doesn't  
25 have to be -- doesn't have to be wider.

1 Q. I didn't say wider. Let me --

2 A. I'm sorry.

3 Q. Let me start again.

4 I believe you testified that a broad  
5 peak is one that is broader than a high and narrow  
6 peak. Is that correct?

7 A. Yes.

8 Q. Okay. And by "broader," do you mean it  
9 occupies more x-axis distance than a high and  
10 narrow peak?

11 A. It doesn't have to, but it would  
12 occupy -- it would -- less x-axis --

13 Q. And you --

14 A. Yeah. And I -- I -- I -- less x-axis is  
15 the difficult part there.

16 Q. So you -- this is -- I'm taking this  
17 phrase, "a broad peak," from your paper.

18 A. Uh-huh.

19 Q. So I'd like you to just, in whatever  
20 words are comfortable to you, to please describe  
21 what that means.

22 A. I -- I mean, I keep coming back to  
23 trying to describe what that peak means, and it  
24 simply is reporting the number of pixels that are  
25 present in the frequency plot along each radian,

1 and it is theoretically possible to have equal  
2 numbers of pixel summation for any number of  
3 radians in a composition.

4 And when that would happen, the -- well,  
5 the alignment of the original data image would not  
6 be as -- would not be as uniform than if the peak  
7 was tall and thin.

8 I mean, it reports from the y-axis the  
9 relative degree of alignment between the two, and  
10 you can think of it as -- I mean, I can't -- I  
11 can't -- I can't get there.

12 Q. So --

13 A. I'm sorry.

14 Q. Do you agree that a broad peak is not  
15 depicted in the plot shown on page 608?

16 A. I think there -- I think visually -- I  
17 think visually that the -- the peaks in plot F  
18 appear to be wider than the peaks on -- depicted  
19 in I.

20 If I measure the peak from the bottom to  
21 the bottom in each of them, it appears to me that  
22 the peak in F encompasses -- or not the peak --  
23 it's -- "peak" is an unfortunate word because it's  
24 the entire plot.

25 "Peak" refer -- "peak" can refer to the

1 top of that squiggly line. And "peak" can also  
2 refer to the entire shape of that squiggly line  
3 forming the cone.

4 If I look at the base of the cone, it  
5 looks to me like the base of the cone occupies  
6 more of the x-axis than the cones that are present  
7 in I.

8 And so I would say relative to I,  
9 knowing what -- where these images came from, that  
10 this is a broader peak in the sense that it's  
11 occupying more of the x-axis, but I -- I can't  
12 really go beyond that.

13 Q. So I'm trying to stick to the language  
14 of your paper, which says "broad peak."

15 Is it your testimony that "broad" is the  
16 same as "wide" in this context?

17 A. Yes.

18 Q. Okay.

19 A. And I think -- I think that it's  
20 important to add that the -- the width -- the  
21 width in a particularly broad peak, which is not  
22 depicted here, if you look at the very top value  
23 where it says about zero 6, a broad peak at, say,  
24 90 degrees in Panel F might have instead of a  
25 sharply delineated point; it might also have -- in

1 addition to having a broad base, it might also  
2 have more of a rounded top because at 91 degrees  
3 the summation of radians is the same as it was at  
4 90, and at 92 it was the same, 93 is the same, and  
5 then it starts to go down to trace the rest of the  
6 plot.

7 In this particular example, the width of  
8 the base of the -- the width of the base of those  
9 traces and the height of those peaks only reaching  
10 0.06 tell me that that scaffold's not as aligned  
11 as the one that is in Panel G.

12 Q. Thank you.

13 On page 610 you also reference a  
14 shoulder on the peak.

15 Do you see that on page 610?

16 A. I do.

17 Q. Okay. Do any of Figures 1-C, 1-F, and  
18 1-I, depict a shoulder on the peak?

19 A. I think subjectively, no.

20 Q. How do you describe a shoulder on a  
21 peak?

22 A. If you look at Panel N, Figure 3, the --  
23 either black arrows represent a shoulder.

24 Q. Okay. Thank you.

25 So you're referring to page 614

1 Figure 3-N in which there are two downward-facing  
2 arrows pointing to the blue portion of the  
3 trace --

4 A. Yes.

5 Q. -- at about 100-ish -- 90 -- a hundred  
6 degrees?

7 A. Yes.

8 Q. And those are shoulders. Okay. Thank  
9 you.

10 All right. Would you turn one more page  
11 to page 615.

12 A. Okay.

13 Q. So the -- the paragraph at the top of  
14 page 615 ends with the sentence: The larger peaks  
15 report the principal axis of alignment, while the  
16 smaller peaks correspond to background  
17 information, noise, and edge effects.

18 Do you see that sentence?

19 A. Uh-huh.

20 Q. Okay. And this relates to the figure we  
21 had seen on the previous page where you identified  
22 the arrows.

23 And the caption of Figure 3 says:  
24 Arrows denote edge-to-noise artifacts.

25 Is that correct?

1       A.    Yes.  The panel says:  2D FFT alignment  
2   plots before and after removing edge effects from  
3   the images depicted in I and L.

4            That's not L.  That's I through L --  
5   no -- I through L.  I, J, K, and L, yes.

6       Q.    And then that next sentence:  Arrows  
7   denote edge noise artifacts?

8       A.    Yeah.

9       Q.    Okay.  All right.  So what do you mean  
10  by "background information"?

11      A.    It's the negative space of an image.

12      Q.    By "negative space" do you mean space  
13  that does not include fibers?

14      A.    Exactly.

15      Q.    Okay.  So is it fair to say then that  
16  any background information appearing in an FFT  
17  plot does not reflect information about the  
18  fibers?

19           MR. LEVINE:  Objection to the form of  
20  the question.

21           THE WITNESS:  You have to have  
22  background to have an edge to detect.  So I  
23  would argue that it -- it contributes -- it's  
24  essential.

25           You couldn't have fibers on a -- you

1       couldn't have black -- this is an extreme  
2       example. You could not possibly have black  
3       fibers on a black background and detect the  
4       edges. You need something in the background  
5       to delineate the -- the shape or position of  
6       an edge of a fiber in order for the technique  
7       to pick it up.

8       BY MS. WIEKER:

9       Q.     Okay. So by "background information,"  
10      your testimony is it's the negative space of an  
11      image?

12      A.     Yes. And there is -- I will add that  
13      there are special circumstances. If you were  
14      imaging a very, very thick scaffold by scanning  
15      electron microscopy, the background is going to be  
16      likely composed of other fibers that are out of  
17      focus, but they'll -- they'll represent the  
18      background noise under those circumstances.

19      Q.     And how do you define "noise"?

20      A.     Noise is something -- for example, in a  
21      light microscopic image where one might take a  
22      photograph, and ten seconds later you take another  
23      photograph, and the detector has had a hiccup and  
24      it's not picking up the same amount -- it's not  
25      reporting the same amount of light in -- in some

1 of the pixels that are present, that's one form of  
2 noise.

3 Q. What's another form of noise?

4 A. There's this concept of edge noise,  
5 which is -- is -- I incompletely understand the  
6 FFT, and it's most evident when fibers are arrayed  
7 from on the diagonal, the FFT has trouble  
8 digesting that angle. Of course, the power of FFT  
9 is you can angle the image any way you want when  
10 you photograph, but that contributes to what's  
11 called the edge noise.

12 The picture essentially forms a parquet  
13 floor with itself, and it's -- the places where  
14 the two images come together where you get edge --  
15 where the mathematics of the system produce these  
16 edge effects, like we saw in Panel N where it's  
17 depicting edge -- edge effect noise because of the  
18 angle of those particular fibers.

19 Q. So is noise reflecting the environment?

20 A. If you have an electrical surge, it  
21 certainly does. It also reflects the -- also  
22 reflects the age and performance parameters of  
23 whatever is capturing the image.

24 Q. Do you -- by that, do you mean the  
25 microscope, the SEM, or bright-field imaging

1 equipment?

2 A. Well, it could be any of those.

3 Q. In this paper, on page 612, you identify  
4 two sources of noise: optical and electronic.

5 A. Uh-huh.

6 Q. Is the optical noise driven by the  
7 amount of light intensity in the environment?

8 A. No, it's not.

9 Q. What is optical noise driven by?

10 A. In my definition of optical noise, it's  
11 the participation of objects that are in the field  
12 of view of the microscope, but not within the  
13 plane of resolution. They're outside that plane.  
14 They still participate in the formation of an  
15 image.

16 Q. Is your statement on page 612 incorrect  
17 then where you say: As light intensity increases,  
18 the amount of optical noise present in the  
19 bright-field microscopic image also will increase?

20 A. No. That's true --

21 Q. Okay. Okay.

22 A. -- if you have a scaffold of some  
23 thickness and you image it at very low light, some  
24 of that light is not going to make it through the  
25 scaffold. And as you increase the amount of light

1 coming through the scaffold, you now begin to  
2 collect an image, because you're passing the light  
3 from below it, through it, and capturing it up  
4 above. And as you add more light, you are now  
5 getting more information from that scaffold, and  
6 as you add more information, progressively more of  
7 it up to some point is not particularly important  
8 for the analysis, because it's -- represents  
9 materials that are out of focus if it's a thick  
10 sample.

11 If the light gets too high, then you  
12 just have a white picture, you don't have anything  
13 in it at all.

14 So there's always a balance between  
15 having enough light and having too much light.  
16 And that's what's demonstrated in Figure 2 of this  
17 document.

18 Q. How would you describe electronic noise?

19 A. Electronic noise are ghosts in the  
20 machine. Electronic noise is -- it's certainly --  
21 part of it is, and modern machines are better at  
22 it than they used to be, isolating and making sure  
23 that the electric supply is constant and not  
24 fluctuating.

25 Kind of a classic example of electronic

1 noise that really kind of also intersects with  
2 optical noise is I took a picture today with my  
3 microscope with the light set at 5, and I came in  
4 tomorrow and I set it at 5, and now it looks  
5 different, it looks brighter or darker.

6 It's probably because there was -- there  
7 is more electricity available to the system and  
8 it's not properly filtered.

9 I mean, that's the best example of  
10 electronic noise.

11 Q. Is detector noise, what you mention  
12 here, a type of electronic noise?

13 A. Oh. Yes, it is. Modern detectors  
14 are -- are pixel arrays. And under sort of normal  
15 operating conditions, it may not be particularly  
16 important for the resulting image, but what  
17 happens with pixel noise, what can happen with  
18 pixel noise is -- and I should define "noise."

19 "Noise" is something that's usually  
20 nonconsistent.

21 So if I look at something and I -- if I  
22 could see an individual pixel fluctuate, I would  
23 say, "Oh, that is electronic noise."

24 And if I looked at it five seconds later  
25 and it was not fluctuating, and it was back to the

1 normal value that I expected it to be, that would  
2 be noise by definition.

3 The way you get around that in digital  
4 cameras and scanning electron micrographs is that  
5 you photograph the sample over some interval of  
6 time so that any fluctuations in the electronic  
7 noise are minimized. And most modern equipment,  
8 anything from, I don't know, 2000 is certainly  
9 modern, is so isolated that that's kind of a minor  
10 problem. It's more important under low light  
11 conditions than it is under what we would consider  
12 ambient light conditions in this room.

13 Q. So you said, definitionally, noise is  
14 nonconsistent.

15 Is it reproducible?

16 A. No, that -- you mean the electronic --  
17 the electronic noise, because it's random, if you  
18 had 900 pixels in either direction and one pixel  
19 flashed, it might want to flash again and it might  
20 not. It's a random quantum mechanic phenomenon.

21 Q. So when you said, definitionally, noise  
22 is nonconsistent, is that electronic noise only or  
23 is optical noise also nonconsistent?

24 A. Difficult question to answer.

25 Electronic noise is certainly random.

1           Optical noise, I can imagine  
2   circumstances where it could be random or  
3   inconsistent, and that would be under what we  
4   discussed before where the light source was not  
5   stable, and it was -- you know, it was changing in  
6   intensity, that would change the quality of the  
7   final image.

8           So there certainly are circumstances.

9           Q.    Okay.  What would noise look like on an  
10   FFT plot?

11          A.    FFT plot, the best example of that --  
12   let's look at these graphs here.

13                I would not -- looking at a graph, I  
14   would not necessarily know the source of the  
15   noise.  But if you look at -- I think probably our  
16   bright-field images are maybe the nicest.

17                Notice in Panel C you have the random  
18   elements in -- this is Figure 1, notice how the  
19   line that is forming those four little random  
20   peaks is jumping up and down.  That's partly due  
21   to noise.  That's partly due to the fact that this  
22   particular sample is, observationally, quite  
23   random.  So the FFT bumps into an edge frequently.

24                There appears to be, to my mind, less  
25   noise in the other two peaks, the -- which means

1 that the pixel summation values are not jumping  
2 around as much.

3 And, of course, the -- this would be  
4 unique to each imaging modality and what you  
5 would -- how you would evaluate it, what you would  
6 look for.

7 Q. Can I turn you back to page 614, please.

8 Okay.

9 A. Okay. I'm there now.

10 Q. So in Figure 3-N, you indicated the  
11 arrows denote edge noise artifacts.

12 How can you just tell -- how can you  
13 discern that those are edge noise artifacts as  
14 opposed to some other indication of, for example,  
15 a difference in alignment in the scaffold?

16 A. Well, I think the simple answer there is  
17 that by placing a mask over the sample, they  
18 disappeared. If there was some other orientation,  
19 that wouldn't have happened.

20 Q. Now, what if you hadn't applied a mask,  
21 how would you -- looking at Figure 3-N, can you  
22 discern noise from a representation of alignment?

23 A. The noise peaks are very small. They're  
24 small shoulders on the height of a much taller  
25 peak at about 50 and about 230 degrees apart from

1 one another.

2 Q. Okay. Now, how would you define  
3 "artifact"?

4 A. Hmm. Artifact. That would be the  
5 information -- the information -- well, in this  
6 case, this little shoulder on this -- on this  
7 particular plot in a way does represent an  
8 artifact in the sense that it is not participating  
9 and telling me anything important about the data  
10 image. That's one kind of artifact.

11 Q. And is that because in this instance in  
12 Figure 3-N, that's detecting the 45-degree  
13 alignment of the fibers? I think that's what you  
14 reference --

15 A. No, it's -- it's the -- it's the  
16 shoulders there. Which substantially don't change  
17 the read-out from the y-axis, whether they're  
18 present or not in the two different plots, red or  
19 the blue. Removing that kind of noise is  
20 important if you're trying to calculate the area  
21 under the curve. Something we found to be onerous  
22 and not useful.

23 Q. So on page 615 in the -- the second full  
24 paragraph, it says: As noted in the previous  
25 section, edge effects and background noise and

1 detector noise can "spill over" and obscure data  
2 in a 2D FFT frequency alignment plots. This noise  
3 effect is quite pronounced in a model scaffold  
4 containing aligned fibers that are -- are arrayed  
5 approximately 45 degrees with respect to the edges  
6 of the image. Figure 3-I, arrow J indicates  
7 noise. Noise of this nature can be greatly  
8 diminished by placing a grayscale window mask over  
9 the fiber field prior to analysis. Figure 3-K,  
10 arrow in L indicates the reduced noise. The  
11 unmasked image produces a 2D FFT alignment plot  
12 with artifacts in the guise of small peaks on  
13 either side of the alignment peaks. Figure 3-N,  
14 arrows.

15 So are those -- in Figure 3-N, the  
16 shoulders on the peaks you identified with the  
17 arrows, are those due to the 45-degree array of  
18 fibers?

19 A. In this particular example, yes.

20 Q. Okay.

21 A. Since the mask removed it.

22 Q. Okay. Okay. Can we go back to page  
23 610, please.

24 A. Okay.

25 Q. In the middle of that first paragraph

1 you say: The 2D FFT alignment plots generated  
2 from sample scaffolds containing aligned elements  
3 exhibit asymmetrical peaks; two larger peaks at 90  
4 and 270 degrees, and two smaller peaks at zero and  
5 360 degrees.

6 Figure -- if you'd like to refer to it,  
7 Figure 1-I that you're referring to there is on  
8 page 608.

9 What do the smaller peaks at zero and  
10 360 represent?

11 A. We are on 6 -- oh, 608. Okay. Now say  
12 that again. What are the smaller peaks?

13 Q. Yeah. In -- on page 610, you said it  
14 shows two smaller peaks at zero and 360, and I'm  
15 wondering what those smaller peaks represent.

16 A. Most of that information is background  
17 information. So if you look at D, there's  
18 background information. There's kind of a gray  
19 that's there.

20 Q. And how do you discern that that's  
21 background information as opposed to an indication  
22 that there's more than one axis of alignment  
23 present?

24 A. Usually those little peaks -- always  
25 those little peaks are symmetric. Those little

1 noise peaks. And they are much smaller than the  
2 principal peaks. The definition -- or operating  
3 definition is the principal peaks report the  
4 alignment. That's not the tallest peak in the  
5 picture.

6 Q. Okay. Let's turn back to Exhibit 1,  
7 which was your declaration from the '248 IPR. And  
8 I'd like to look at paragraph 46, which is on page  
9 25, starts on 25.

10 A. I'm sorry. What page? 25, you said?

11 Q. Starts on 25, yes.

12 A. All right. I'm there.

13 MR. LEVINE: Did you say paragraph 46?

14 MS. WIEKER: Paragraph 46, starting on  
15 page 25.

16 MR. LEVINE: Okay.

17 BY MS. WIEKER:

18 Q. The paragraph states: When creating the  
19 2D FFT alignment plot, it is sufficient to some  
20 pixel intensities from zero to 180 degrees, which  
21 is the standard reporting practice -- practice.

22 Correct?

23 A. Yes.

24 Q. Okay.

25 A. But there's information always from that

1 output from zero to 360. It's a choice of the  
2 user whether they want zero or 180.

3 I technically preferred 180 so I could  
4 see all the peaks in a plot.

5 Q. Is there a reason you wouldn't be able  
6 to see all the peaks in a plot if you plotted to  
7 360?

8 A. No, because it only goes from -- it only  
9 goes to 360.

10 Q. Right. Let me just be sure you -- your  
11 testimony. You said, "I technically preferred  
12 180, so I" --

13 A. No. I --

14 Q. -- "could see all the peaks" --

15 A. No, I'm --

16 Q. -- "in a plot."

17 A. -- I'm sorry. I technically prefer a  
18 summation around 360. But it's perfectly  
19 acceptable in the literature to use only zero to  
20 180 with the knowledge that all that other  
21 information is out there for the other symmetric  
22 peak that's 180 degrees apart from the first one  
23 that you're showing in your plot. That  
24 information is captured by default.

25 Q. So when you say you preferred 360, why

1 is that?

2 A. I liked to see the shape of the entire  
3 trace so that I -- because I felt that it provided  
4 me a better understanding of the background noise  
5 and, you know, other parameters that might be  
6 present in the peak; how noisy it is, is it  
7 consistent across, and in a light field image, it  
8 would tell me if the lighting illumination was  
9 even or not if I have all the peaks to look at.

10 Q. That paragraph continues on to say that:  
11 Reporting to 180 degrees is sufficient because the  
12 2D FFT output image is symmetric about the  
13 horizontal axis, so a pixel summation to 360 is  
14 unnecessary.

15 What do you mean by "symmetrical about  
16 the horizontal axis"?

17 A. The position of the principal peaks will  
18 be symmetrical. If one is at a hundred, the other  
19 one will be 180 degrees apart from it.

20 Q. But it -- that sentence is about the  
21 output image, right? There are no peaks in an  
22 output image, are there?

23 A. That's the data set that produces the  
24 image.

25 Q. Right. So when you say -- I'm -- I'm

1 quoting here. It says: The 2D FFT output image  
2 is symmetric about the horizontal axis.

3 So what does that mean in terms of the  
4 output image?

5 A. Oh, I see. This is because the 2D  
6 output image is symmetric. I -- I see. If we  
7 look at the Panel Number E in figure -- I don't  
8 know what that figure number is, whatever that  
9 picture is on page 25, and we look at the  
10 distribution of pixels in that image, we can see  
11 that there are pixels that are kind of along a  
12 bright line at 90 degrees, and there's a  
13 correspondingly bright line going inferiorly  
14 towards 270 degrees, so that's the symmetry of the  
15 2D FFT output image.

16 Q. And just for clarity of the record,  
17 you're referring to paragraph 45 of your  
18 declaration, the image shown kind of in the middle  
19 second row as E?

20 A. Yes.

21 Q. And what you're referring to is  
22 basically the illumination that appears vertical  
23 in that image; is that correct?

24 A. Correct. That is reporting the  
25 principal axis of alignment.

1 Q. Uh-huh.

2 A. Now, there's also some symmetry in the  
3 other orientations, but only one you ever really  
4 care about is what is the principal axis of  
5 orientation.

6 Q. And the figure above that that's marked  
7 B --

8 A. Uh-huh.

9 Q. -- is that also symmetric about the  
10 horizontal axis?

11 A. Actually, no, it's not.

12 That particular image is showing -- and  
13 to my eye, I don't see it, the FFT is actually  
14 reporting that there is some kind of -- looks like  
15 some degree of alignment along -- I can't read the  
16 number -- I can't tell if 90's in the middle, but  
17 where the -- where that broad peak is being  
18 depicted in that panel is telling me that there's  
19 the onset of some preferential alignment along  
20 that particular angle, which looks to be somewhere  
21 around 80 degrees or something like that, and it's  
22 very broad because there's more than one principal  
23 angle showed in that what ostensibly is a random  
24 matrix.

25 Q. So in paragraph 45, the Image B, there

1 is not horizontal symmetry about the horizontal  
2 axis?

3 A. Well, if we took that plot out to  
4 360 degrees, there would be another hump like we  
5 see in that.

6 Q. You know, to be clear, I'm not asking  
7 about the FFT plot. I'm asking about the output  
8 image.

9 A. Okay.

10 Q. And is the output image in Figure B  
11 there symmetric about the horizontal axis?

12 A. No, because it's substantially -- oh,  
13 okay. I see what you're -- I see what you're  
14 getting at.

15 Q. I'm just trying to map --

16 A. Yeah.

17 Q. -- 45 to -- paragraph 45 to 46.

18 A. Yeah. The -- the perfect random image  
19 will produce a perfectly -- this is a thought  
20 experiment. That's the only way to describe it.  
21 The perfectly random image should produce a  
22 perfectly shaped sunburst in the 2D FFT plot here.

23 Q. Do -- I'm sorry to stop you there. The  
24 2D FFT plot or the image?

25 A. The image, the -- the -- the output

1 image. I'm referring to B and E in this  
2 particular figure.

3 There's no perfect randomness in -- I --  
4 well, I don't think there's perfect randomness.  
5 But in a -- in a thought experiment where I  
6 produce something that looks completely random,  
7 the starburst in the center should look the same  
8 in all directions.

9 In this particular case, it's reporting  
10 that there's a slight amount of alignment going  
11 along in one direction that seems more  
12 preferential than other directions. It's very  
13 modest, because when I look at the picture, my  
14 eye's not picking up on it. I think it might be a  
15 little bit there from top to bottom, a little bit  
16 from the bottom corner to the top corner, and a  
17 little bit left to right. So it's really hard to  
18 tell, hence the -- the plot has a broad, flat  
19 peak, because there's multiple alignment  
20 orientations there.

21 And if I traced that circle around and  
22 looked at the pixel summation 180 degrees from  
23 where it is right now, I would see the same peak  
24 that's depicted in the zero to 180-degree plot.

25 Q. Okay. Again, I'm not asking about the

1 plot here.

2 My question is in Figure B of paragraph  
3 45, that depicts the 2D FFT output image, is that  
4 output image symmetric about the horizontal axis?

5 MR. LEVINE: Objection to the form of  
6 the question.

7 THE WITNESS: I -- I don't know how to  
8 answer that because I -- I can't see all the  
9 information there. Just -- I -- I mean, I --  
10 I don't know. It's -- there's some alignment  
11 there, so --

12 MR. LEVINE: You said -- you answered.

13 THE WITNESS: Yeah. There's some  
14 alignment. And if there's some alignment,  
15 there -- there's --

16 MR. LEVINE: There's no question  
17 pending, Dr. Simpson.

18 THE WITNESS: Okay.

19 BY MS. WIEKER:

20 Q. Dr. Simpson, turning to paragraph 46  
21 again, at the end of the second line: As a way of  
22 further explanation, the fact that the 2D FFT  
23 output image is symmetric about the horizontal  
24 axis, I'm going to omit the parenthetical there,  
25 it continues, ensures that the peaks in the 2D FFT

1 alignment plot repeat between zero to one --  
2 180 degrees, and 180 degrees to 100 --  
3 360 degrees.

4 My question is in Figure 1-B, you said  
5 the FFT output image is symmetric about the  
6 horizontal axis, and all I'm trying to figure out  
7 is whether Figure B from paragraph 45 is symmetric  
8 about the horizontal axis?

9 A. It's a random matrix. Random matrix  
10 composed of many different fibers. And I don't  
11 know if it's symmetric about the horizontal axis  
12 because it's not plotted to 360 degrees.

13 The only way you would know that is if  
14 you summed the pixel values, and I don't have that  
15 information.

16 Q. Okay. So to answer that question, would  
17 you need the full FFT plot out to 360 degrees?

18 MR. LEVINE: Objection to the form of  
19 the question. Mischaracterization.

20 MS. WIEKER: It's -- it's not a  
21 characterization. Let me rephrase.

22 BY MS. WIEKER:

23 Q. To determine whether Figure B in  
24 paragraph 45 is symmetric about the horizontal  
25 axis, what additional information would you need?

1       A.    The original data set from ImageJ  
2 produces 360 degrees of information. In this  
3 particular plot, only 180 is depicted.

4            If -- if I had the original digital  
5 output, the Excel spreadsheet of the 360 degrees,  
6 I could then discern whether there is a symmetric  
7 peak.

8            And there's no obligation for the peak  
9 to look exactly the same as the peak that's  
10 present in that image. There's -- because it's a  
11 random scaffold. Now, I would expect the peak to  
12 look extremely similar in a random matrix, which  
13 is totally different beast than anything that has  
14 substantial alignment to it.

15           But again, I would just have to have  
16 the -- the original Excel output from the FFT  
17 produces information to 360 degrees, and the user  
18 chooses whether to use it all or discard half of  
19 it, meaning plotting zero to 180.

20       Q.    Okay. I think this is my final question  
21 on the output image statement.

22           Is that statement, the fact that the 2D  
23 FFT output image is symmetric about the horizontal  
24 axis, is that always true?

25       A.    In an aligned scaffold, it is.

1 Q. Apart from an aligned scaffold?

2 A. I can't say one way or the other because  
3 our interests were primarily aligned. The whole  
4 point of that is to determine alignment in a  
5 sample. I've seen hundreds and hundreds of FFT  
6 plots for aligned things, only a handful of random  
7 ones.

8 Q. Okay.

9 MR. LEVINE: Is this a good time for  
10 lunch?

11 MS. WIEKER: I have one more question.

12 BY MS. WIEKER:

13 Q. The -- there's a parenthetical we  
14 skipped over in paragraph 46 that says that the  
15 pixel intensity at 1 degree is the same as at  
16 181 degrees, 2 degrees is at -- is the same as  
17 182 degrees, et cetera.

18 Are there any circumstances where that  
19 would not be true?

20 A. If you have symmetric peaks, no. The  
21 peaks -- there's nothing in the technique that  
22 says that it has to be exactly the same from the  
23 Ayres paper. After all, you're looking at  
24 something like 900 square -- if you're looking at  
25 some of these images, they're 900 pixels squared.

1 Q. Are there any circumstances where a peak  
2 between zero and 180 would not repeat between 180  
3 and 360?

4 A. Not in an aligned scaffold.

5 Q. What about in a random scaffold?

6 A. As -- as I said, I -- I can't say.

7 I would -- I would only be guessing.

8 Q. Okay. What about if the FFT were  
9 performed with a complex valued input?

10 A. I don't know what that is.

11 MS. WIEKER: Okay. Okay. Let's --

12 let's stop there and break for lunch.

13 THE VIDEOGRAPHER: The time is  
14 12:34 p.m., we are now off the record.

15 (Luncheon Recess taken at 12:34 p.m.,  
16 proceedings resumed at 1:16 p.m.)

17 THE VIDEOGRAPHER: The time is  
18 1:16 p.m., we are now on the record.

19 BY MS. WIEKER:

20 Q. Dr. Simpson, I'd like to ask you just a  
21 question with a yes-or-no answer.

22 During the break, did you discuss the  
23 substance of your testimony with Mr. Levine?

24 A. No.

25 Q. Okay. Thank you.

1 I'd like to return briefly to your Ayres  
2 2008 paper, which was marked as Exhibit 4.

3 MR. LEVINE: Do you have that one?

4 THE WITNESS: Yeah, I do. Yeah.

5 MR. LEVINE: That one.

6 THE WITNESS: Just -- just got to  
7 uncover it.

8 MS. WIEKER: Just two follow-up  
9 questions here.

10 BY MS. WIEKER:

11 Q. Could you turn to page 606, please.

12 A. Okay.

13 Q. Okay. I want to read part of the first  
14 paragraph up there to you.

15 You say: We believe that measurements  
16 of scaffold and isotropy should be averaged over  
17 as large of -- of an area as possible. Local  
18 variations in fiber alignment can bias the 2D FFT  
19 process. If necessary, alignment data can be  
20 captured from several sites in the scaffold and  
21 averaged to circumvent the limitations inherent in  
22 a small sample surface area must be used to  
23 generate an alignment value.

24 Do you agree with that statement?

25 A. I do.

1 Q. Okay. Okay. And turning to page 618.

2 A. Okay.

3 Q. Towards the bottom, four lines from the  
4 very bottom, I'll read what it says here.

5 Structures that exhibit discrete fiber  
6 layers that are engineered to display differing  
7 degrees of alignment in each layer are generally  
8 not suited for analysis by bright-field  
9 microscopy.

10 Do you agree with that statement?

11 A. Structures that exhibit discrete fiber  
12 layers that are engineered to display differing  
13 degrees of alignment --

14 Yes.

15 Q. Okay. Thank you. All right. You can  
16 put that paper away for -- for now at least.  
17 Thank you.

18 MS. WIEKER: I'd like to introduce the  
19 next exhibit, which I believe will be marked  
20 as 5.

21 (Simpson Deposition Exhibit 6 marked for  
22 identification.)

23 THE REPORTER: 6.

24 MS. WIEKER: 6. I'm sorry.

25

1 BY MS. WIEKER:

2 Q. Do you recognize this publication,  
3 Dr. Simpson?

4 A. I do.

5 Q. Is this the paper that you cite in your  
6 declarations as Huang 2?

7 A. It is.

8 Q. Okay. And if I refer to this as  
9 Huang 2, you'll understand what I mean?

10 A. Yes.

11 Q. Okay. When did you first learn of  
12 Huang 2?

13 A. I have a feeling that I may have read  
14 this paper shortly after it came out, and in  
15 recent work on this project, it came to the  
16 surface again, and I honestly can't say if I read  
17 it back in 2012 or not, but it seems very  
18 familiar. But certainly in the last year or so,  
19 I've been familiar with it.

20 Q. And as applied to the PTAB proceedings  
21 here, did you discover the reference yourself?

22 A. I did not.

23 Q. Okay. Who gave it to you?

24 A. The attorneys in the case.

25 Q. Okay. Would you consider Huang 2 to be

1 a reliable source of information for a person of  
2 ordinary skill in the art?

3 A. I do. It's a good journal.

4 Q. Okay. All right. Let's start with  
5 page 1793.

6 MR. LEVINE: Do you see the page numbers  
7 that are up there?

8 THE WITNESS: Yeah.

9 MS. WIEKER: Sorry. I'm referring to  
10 the page numbers at the top of the journal  
11 article.

12 THE WITNESS: I -- I've got -- I'm on --  
13 I'm right, right now --

14 MS. WIEKER: Okay.

15 THE WITNESS: -- right?

16 MS. WIEKER: You got it. Yeah. Okay.

17 BY MS. WIEKER:

18 Q. So on page 1793, you'll see Figures 1-A  
19 and 1-B. Is that correct?

20 A. Yes.

21 Q. And are these images of fibers?

22 A. Yes.

23 Q. And do you agree that Huang 2 captured  
24 these images with SEM?

25 A. Yes, I do.

1 Q. Okay. So if I refer to the SEM image in  
2 Figure 1-B of Huang 2 as the "Figure 1-B image,"  
3 will you understand what I'm referring to?

4 A. Yes.

5 Q. Okay. Do you know the parameters under  
6 which the authors of Huang 2 obtained the  
7 Figure 1-B image?

8 A. The conditions are placed in -- in 2.2  
9 on page 792, second paragraph, right-hand column.

10 Q. And this is where it discusses  
11 examination with a LEO 982 FEG SEM --

12 A. Yes.

13 Q. -- is that correct? Okay.

14 Do you know whether the authors of  
15 Huang 2 optimized sample illumination?

16 A. I have no idea.

17 Q. Do you know what resolving power was  
18 used?

19 A. I have no idea.

20 There is a 5-micron bar on each image,  
21 so at least 5 microns.

22 Q. Do you agree that Huang performed FFT  
23 based on five images of randomly selected areas of  
24 its scaffold?

25 A. I want to actually read it.

1 Q. Why don't I point your attention to  
2 two -- two areas, and then I'll re-ask the  
3 question --

4 A. Okay.

5 Q. -- if that's okay.

6 A. That's helpful.

7 Q. Okay. So under -- on page 1792. In  
8 that section 2.2 that you referred to a moment  
9 ago, right after the identification of LEO 982,  
10 the reference says: To determine the diameter of  
11 nanofibers, images of five randomly selected areas  
12 were captured and analyzed by NIS-elements BR 3.10  
13 analysis software from Nikon.

14 And then I'd also turn to page 1794, in  
15 the results section about six lines down, it says:  
16 To better analyze the fiber alignment, FFT  
17 analysis was performed on the SEM images of  
18 randomly selected area, parentheses, N equals 5,  
19 to characterize the anisotropy and assign a  
20 numerical value to fiber orientation.

21 A. Yes, I agree to your previous -- and I  
22 say yes to your previous question, too.

23 Q. Okay. And for the record, I'm just  
24 going to restate it so that we've got it all  
25 together.

1 A. Uh-huh.

2 Q. You agree that Huang 2 performed FFT  
3 based on five images of randomly selected areas of  
4 its scaffold, correct?

5 A. I do.

6 Q. Okay. And do you agree that on  
7 page 1793, in the Figure 1-B image, that is only a  
8 single image of one area of the scaffold?

9 A. I do.

10 Q. Okay. In your declarations, you state  
11 that you performed your own FFT analysis of the  
12 Figure 1-B image. Is that right?

13 A. Yes.

14 Q. Did you personally perform this testing?

15 A. I did.

16 Q. Did anyone assist you?

17 A. No.

18 Q. Okay. You state that you used the FFT  
19 analysis described in Huang 2 and the '223 or '227  
20 Patent respectively. Is that right?

21 A. Uh-huh.

22 Q. Okay. And you reproduced the resulting  
23 FFT alignment plot in your declarations for each  
24 IPR; is that right?

25 A. I think it's in both. I think the same

1 one is used in both, yes.

2 Q. And if you want to just check, I  
3 think -- if you're on the '294 IPR, paragraph 110  
4 describes your analysis and includes your FFT  
5 plot.

6 A. Picture, yeah. I'm -- I'm sure we have  
7 it, both of them.

8 MR. LEVINE: Did you say the '294?

9 MS. WIEKER: If I -- if I --

10 THE WITNESS: '249.

11 MS. WIEKER: I -- I did. Sorry. I --  
12 no, we'll go back. Thank you for clarifying.

13 BY MS. WIEKER:

14 Q. In the '248 IPR Declaration which  
15 addresses the '223 Patent, you see paragraph 110.  
16 And for the '249 IPR Declaration which addresses  
17 the '227 patent, you would be at paragraph 125.

18 A. It's affirmative on both those, that's  
19 the same figure.

20 Q. Okay. Did you generate only one FFT  
21 alignment plot based on the Figure 1-B image?

22 A. Yes.

23 Q. Okay. What was the first step in  
24 performing your FFT analysis of Huang's  
25 Figure 1-B?

1       A.    I got an original download from the  
2    biomaterials website so that I would have an image  
3    as close to the original as I could get, as  
4    opposed to a Xerox like this.

5       Q.    And was it a single image you  
6    downloaded?

7       A.    That's the only image they have.

8       Q.    And what would be the -- what -- what  
9    was the reason you declined to use a Xerox of the  
10   Figure 1-B image?

11      A.    It would work.  I prefer to work from as  
12   close to the original as possible, but that  
13   certainly would provide an FFT that's perfectly  
14   suitable and adequate to show that it's aligned.

15      Q.    In what format was the downloaded image?

16      A.    PDF.

17      Q.    To what extent had the PDF been  
18   compressed from the original image obtained by the  
19   SEM described on page 1792?

20      A.    I would have to do some math.  The  
21   original -- the original data image that was  
22   scanned was said to be 905-by-905 pixels.  This is  
23   2 inches.  So whatever factor 950 squared  
24   versus --

25      Q.    Let me ask this differently.

1 Did you document in your report anywhere  
2 the image format downloaded from biomaterials or  
3 any compression associated with that image?

4 A. I'm not aware that I did. We worked  
5 with the best image we could get.

6 Q. So you performed your FFT analysis on  
7 this downloaded image that is reproduced in  
8 Figure 1-B of Huang 2.

9 Do you know which of the five SEM images  
10 of randomly selected areas that Figure 1-B  
11 corresponds to?

12 A. I can only -- no.

13 Q. Do you know anything about the other  
14 randomly selected areas of the scaffold that  
15 Huang 2 tested?

16 A. It's not disclosed.

17 Q. Was Huang 2's image stored as a TIF or a  
18 JPEG file?

19 A. I have no idea.

20 Q. Did you use ImageJ software to generate  
21 the FFT alignment plot that you provide in your  
22 report?

23 A. Yes.

24 Q. Which version of the software did you  
25 use?

1       A.    I don't know that we reported that.  I  
2   have no idea.  Whatever was on my computer at the  
3   moment.  It may be -- it may or may not be in my  
4   paper here.

5       Q.    I couldn't find it in your --

6       A.    It didn't stand out.

7       Q.    -- declaration.

8       A.    Yeah.  It might be in here somewhere.  I  
9   do not remember.

10      Q.    Did you calibrate the angle information  
11   concerning the principal direction of fiber  
12   alignment to the version of the ImageJ software  
13   that you used?

14      A.    I didn't have to.  The software had been  
15   corrected.

16      Q.    And did you adjust any aspects of the  
17   downloaded image prior to your testing, for  
18   example, adjust contrast or anything like that?

19      A.    I did not have to.

20      Q.    Why would you have to?

21      A.    Well --

22           MR. LEVINE:  Objection to the form of  
23   the question.

24   BY MS. WIEKER:

25      Q.    In what circumstances would it -- you

1 don't -- you don't have to look at Mr. Levine.

2 MR. LEVINE: Oh. Yeah, don't --

3 THE WITNESS: I'm looking out the  
4 window.

5 BY MS. WIEKER:

6 Q. Okay.

7 A. Yeah, I -- I -- I assure you I'm not  
8 looking for answers from him; I'm looking out the  
9 window.

10 I -- from a high quality journal, the  
11 photographs ought to be adequate the way they are.  
12 And if they're not, the journal won't publish  
13 them.

14 You should always be collecting data  
15 with the best capability that you have.

16 So there's really -- adjusting contrast  
17 and light has a very -- in a -- in a done in  
18 image, has a very -- is of limited use.

19 Q. Did you apply a mask to Huang 2's  
20 Figure 1-B?

21 A. I did.

22 Q. Huang doesn't describe applying a  
23 circular mask to the images, does it?

24 A. I think it does. Cropped images were  
25 processed with a Fast Fourier Transform, and then

1 a circular selection of the image was made,  
2 maximizing the amount of the selected edges of the  
3 circle with the edges of the image. That's a  
4 mask.

5 Q. Isn't -- actually -- is that not  
6 referring to the circular projection applied to  
7 the image to generate the FFT alignment plot?

8 MR. LEVINE: Counsel, just for the  
9 record, do you want him to identify where he  
10 was reading from?

11 MS. WIEKER: He was --

12 MR. LEVINE: It's up to you. I  
13 didn't want him to clarify --

14 MS. WIEKER: Yeah. I can clarify in a  
15 minute, please.

16 BY MS. WIEKER:

17 Q. Dr. Simpson, while you're looking at the  
18 paper, I'm reading from page 1792 in section 2.2,  
19 the Huang 2 reference.

20 A. Yeah.

21 Q. And I believe that's where you quoted,  
22 it says: They took the SEM images.

23 Then it says: These cropped images were  
24 then processed with a Fast Fourier Transform, FFT,  
25 and then a circular selection of the image was

1 made, maximizing the amount selected. Edges of  
2 the circle were tangent with the edges of the  
3 image.

4           Isn't that what you were discussing  
5 earlier about the way you generate your output  
6 image; you apply the circular projection, and you  
7 indicated in your lab you'd always require that it  
8 go to the edges of the images?

9           A.    These cropped images -- process  
10 [reading].

11           I -- I -- I misinterpreted this on our  
12 initial read-throughs through this. I believe  
13 that he had used a mask.

14           Q.    Is a mask shown in image -- I'm sorry --  
15 the Figure 1-B image?

16           A.    There's no mask there. That's the  
17 original data image that is too big to process.

18           Q.    And to your recollection, does the '223  
19 Patent apply a mask?

20           A.    I don't know one way or the other.

21           Q.    Okay. We can return to that.

22           A.    It's a different kind of microscopy, it  
23 would have different requirements for producing  
24 the analysis. It's a bright-field image.

25           Q.    So do you see in the Huang 2 paper on

1 page 1792 in the third paragraph of the right  
2 column, you'll see there's a sentence: The  
3 orientation of electrospun nanofibers was  
4 determined by using the ImageJ program (NIH) along  
5 with an oval profile plot plug in, and it cites to  
6 Reference 22.

7 If you turn to the back of the  
8 publication, Reference 22 is to an Ayres 2006  
9 publication.

10 Do you see that?

11 A. Yes.

12 Q. Okay. So let's take a look at that to  
13 see if Ayres 2006 employs a mask.

14 Let me get you the right --

15 A. This is 2008.

16 MS. WIEKER: So could we mark this,  
17 please, as Exhibit 7.

18 (Simpson Deposition Exhibit 7 marked for  
19 identification.)

20 THE WITNESS: Thank you.

21 MR. LEVINE: Exhibit 7?

22 MS. WIEKER: 7.

23 BY MS. WIEKER:

24 Q. And, Dr. Simpson, would you take a  
25 minute to look at Exhibit 7 and see if you can

1 find any discussion of the mask in there.

2 A. There wasn't a need for a mask. All  
3 this information was generated from an SEM, and  
4 those are usually clean enough that there's not  
5 much noise. So it's optional as to whether you  
6 want to use a mask or not.

7 Q. And in Huang 2, that was also obtained  
8 with an SEM?

9 A. That's obtained with an SEM.

10 Q. Okay.

11 A. And I used a circular mask because I  
12 misread that sentence.

13 Q. Okay. Did you also generate an FFT plot  
14 for Huang's Figure 1-B without a mask?

15 A. I can't definitively say I did, but I  
16 certainly definitively can't say that I didn't.  
17 I'm sorry I can't really answer that for sure.

18 Q. If you had performed an FFT alignment  
19 plot for an unmasked Figure 1-B, would you have  
20 included it in your declaration?

21 A. I think that that work was done in my  
22 office, and with this paper open, trying to  
23 produce the results that -- or try to reproduce  
24 the methods that they were using. And so such a  
25 plot might exist, but I was trying to emulate what

1     their -- their -- what I thought their description  
2     said.

3           Q.     And what did that FFT plot disclose of  
4     the unmasked Figure 1-B?

5           A.     I don't know.

6           Q.     Would you have a record of it?

7           A.     No. Probably not. I didn't log every  
8     FFT I've ever done.

9           Q.     And you don't recall whether you logged  
10    the plot of the unmasked Figure 1-B?

11           MR. LEVINE: Objection. Foundation.

12    BY MS. WIEKER:

13           Q.     Do you recall whether you logged --

14           A.     I don't recall. No, I did not log -- I  
15    did not routinely -- I did not routinely log  
16    individual pictures that I processed by FFT,  
17    unless you refer to logging as putting it in the  
18    declaration, then yes, it was logged in the sense  
19    that it's permanently a part of that document.

20           Q.     I guess let me go back then.

21                   Do you recall whether you generated an  
22    FFT plot for Huang's Figure 1-B without a mask?

23           A.     I -- I don't know. I -- I just don't  
24    remember.

25           Q.     How did you determine where to apply

1 your mask on Huang's Figure 1-B?

2 A. Well, I had to select -- first, it had  
3 to be -- that's not the first step in the process.  
4 The first step is to get a perfect square of an  
5 image, and so I selected the largest square that I  
6 could possibly get out of that image, cropped it,  
7 and then put the circular mask on it.

8 Q. And did you immediately -- okay. Let me  
9 point you to your report for the '248 IPR at  
10 paragraph 110.

11 MR. LEVINE: Exhibit 1.

12 THE WITNESS: Paragraph 110?

13 BY MS. WIEKER:

14 Q. Uh-huh.

15 A. Okay.

16 Q. So if you see the mask you apply to your  
17 image, and if you compare that to Huang 2's  
18 Figure 1-B, it appears that your mask was applied  
19 to the left portion of Figure 1-B. Is that  
20 correct?

21 MR. LEVINE: Objection to the form of  
22 the question.

23 THE WITNESS: Again, I cropped the image  
24 to the maximum size that I could get from  
25 this image, somewhere from the --

1 approximately where 5-micron -- the little  
2 5-micron bar is to the edge at an equal  
3 height in pixels up. That's the largest  
4 piece I could sample from it.

5 BY MS. WIEKER:

6 Q. And is that why you applied the mask  
7 toward the left of the edge?

8 A. No.

9 MR. LEVINE: Objection to the form of  
10 the question.

11 BY MS. WIEKER:

12 Q. Why did you apply the mask to the left  
13 of the image?

14 A. I did not.

15 Q. Where did you apply it on Figure 1-B in  
16 Huang 2?

17 A. I trimmed the original data image to a  
18 perfect square based on pixel dimensions, and then  
19 placed the mask over the -- centered that mask  
20 over that remaining square unit of information.

21 Q. So did you trim out the right portion of  
22 Figure 1-B above the legend that says  
23 "5 micrometers"?

24 A. I did, because I could not get a larger  
25 square of information.

1 Q. Okay. Did you run any FFT analyses with  
2 the mask applied elsewhere?

3 A. No. No. On that image, no.

4 Q. So once you applied the mask to the  
5 largest area of Figure 1-B that you could, what  
6 did you do next to obtain your output image?

7 A. I selected it from the menu in ImageJ,  
8 FFT -- 2D FFT. And it produced the power  
9 spectrum, the output -- the output image.

10 Q. Did you then apply a circular projection  
11 in ImageJ to generate your FFT plot?

12 A. I placed an oval over B and to do the  
13 radial summation, yes.

14 Q. Okay.

15 A. And like the circular mask, it is -- was  
16 tangent with the edges of the square.

17 Q. Did you document that anywhere?

18 A. I just did it.

19 Q. So you didn't document it, you just --

20 A. I followed --

21 Q. -- defined it?

22 A. -- the technique in Ayres.

23 Q. Okay. Your FFT plot, so this is in,  
24 again, your declaration marked as Exhibit 1,  
25 paragraph 110, your FFT plot reports normalized

1 intensity on the y-axis.

2 How did you normalize this data?

3 A. I -- from the zero to 360-degree data  
4 set, I selected a value that would bring the  
5 lowest portion of the entire plot to approximately  
6 the x-axis.

7 Q. Okay. Now, could we turn back to Huang  
8 page 1793, this is Exhibit 6.

9 Do you see Huang's FFT plot at  
10 Figure 1-C?

11 A. I do.

12 Q. Okay. Would you characterize that as is  
13 a broad peak?

14 A. Not necessarily. It's got a fairly  
15 delineated top on it. It's reporting what my eyes  
16 are saying, that the fibers are arrayed from 90 to  
17 270, even though this particular plot doesn't go  
18 all the way out to 360.

19 Q. So earlier you testified -- I asked the  
20 question: Is your testimony that "broad" is the  
21 same as "wide" in this context when we were  
22 discussing the x-axis.

23 Is that -- you said it was occupying  
24 more of the x-axis; you said yes.

25 A. Relative to some other -- relative to

1 something else.

2 Q. So Huang's plot, which goes from -- the  
3 peak stems from basically zero to 180, is that a  
4 broad peak?

5 A. I can't say.

6 Q. Okay. You also testified: In addition  
7 to having a broad base, it might also have more of  
8 a rounded top.

9 Does Huang's peak there depict a rounded  
10 top?

11 A. Again, I need to have a comparison to  
12 other samples to make that judgment.

13 I do not know how that peak was  
14 generated.

15 I don't know if that is from this image.  
16 I don't know if that peak is the average of five  
17 separate samples collected at five separate times  
18 and averaged together to make that plot.

19 Q. Okay. Thank you. I think we can put  
20 Huang 2 aside for a minute.

21 MS. WIEKER: And then could we please  
22 mark this one as Exhibit 8.

23 (Simpson Deposition Exhibit 8 marked for  
24 identification.)

25

1 BY MS. WIEKER:

2 Q. Dr. Simpson, do you recognize this  
3 document?

4 A. I do.

5 Q. Okay. Is this the Lee publication that  
6 you cite in your declarations?

7 A. Yes, it is.

8 Q. When did you first learn of this  
9 reference?

10 A. When the attorneys suggested it.

11 Q. Would you consider this to be a reliable  
12 source of information for a person of ordinary  
13 skill in the art?

14 A. I would.

15 Q. Does this Lee publication marked as  
16 Exhibit 8 disclose utilizing FFT to analyze fiber  
17 alignment?

18 A. It doesn't have to.

19 Q. Does it?

20 A. It does not. He discloses the material  
21 properties that prove it's anisotropic; he  
22 discloses images that show it's anisotropic; he  
23 measures fiber alignment passing through an image  
24 to demonstrate alignment; and he put cells on it  
25 to demonstrate that they all line up in a global

1 fashion. He just chose to use different criteria.

2 Q. So you agree that Lee did not disclose  
3 using FFT to measure alignment?

4 A. No, he disclosed angle -- fiber angle  
5 alignment.

6 Q. I'm going to ask this one more time to  
7 be sure the record's clear here.

8 Does Lee disclose using FFT to measure  
9 alignment?

10 A. No.

11 Q. Okay.

12 MS. WIEKER: I'll mark this as  
13 Exhibit 9.

14 (Simpson Deposition Exhibit 9 marked for  
15 identification.)

16 MS. WIEKER: It's here for you when  
17 you're ready.

18 MR. LEVINE: Oh, thanks.

19 BY MS. WIEKER:

20 Q. Dr. Simpson, do you recognize this  
21 document?

22 A. I do not recognize the face pages.

23 Q. If you look at the -- the Bates stamp at  
24 the bottom, it says it's Exhibit 1021. Would you  
25 compare this to your declaration where you list

1 the exhibits you considered to see if that  
2 refreshes it to you?

3 A. I'm sorry. Give me that reference  
4 again.

5 Q. It's Exhibit 1021, in the IPRs.

6 A. Oh, this is the provisional patent.  
7 Okay. I know what this is now.

8 Q. Okay.

9 A. I'm sorry.

10 Q. That's fine. Lots of papers.

11 So is this the provisional application  
12 from which you obtained an image to use for FFT  
13 analysis in your declarations?

14 A. Yes, this is a pretty reasonable  
15 facsimile, I think.

16 Q. Is it a facsimile or is it the exhibit  
17 you relied on in -- in your declaration?

18 A. Oh, it's -- I'm sorry. It's -- it's --  
19 yes, it's what I relied on.

20 Q. Okay.

21 A. I'm sorry.

22 Q. That's okay.

23 Did you personally perform the testing  
24 on this image?

25 A. I did.

1 Q. Did anyone assist you?

2 A. No.

3 Q. Do you know the parameters under which  
4 the authors of Lee obtained this image?

5 A. I have no idea. It's a scanning  
6 electron micrograph, that's all I know.

7 Q. Okay. Did you generate only one FFT  
8 plot based on this image?

9 A. I took a square sample from the middle  
10 of the image and processed it.

11 Q. And did you do that one time?

12 A. I did.

13 Q. Okay. And that's what's reproduced in  
14 your declaration?

15 A. Yes.

16 Q. What was your first step in performing  
17 FFT analysis on the Lee provisional Figure 1-D?

18 A. I selected my square from the middle of  
19 the rectangle, trimmed the image, and then  
20 conducted the FFT.

21 Q. So you didn't do your FFT analysis on  
22 the actual image that Lee captured with SEM, did  
23 you?

24 A. That was not available to me.

25 Q. So what you analyzed was a Xerox or a

1 photocopy?

2 A. This image, yes.

3 Q. Okay. So it was a photocopy?

4 A. It was this photocopy.

5 Q. Did you adjust any parameters of that  
6 figure before doing your testing?

7 A. I did not. I took it at face value.

8 Q. Do you normally perform FFT analysis  
9 with a photocopied image?

10 A. As long as an image has edges, you can  
11 do an FFT on it. It's not something I do  
12 routinely, but it was something out of necessity.

13 Q. So you don't normally do that?

14 A. No.

15 Q. In your 2008 Ayres paper which we  
16 discussed earlier, were those images -- I'm sorry,  
17 was that FFT analysis based on photocopied images?

18 A. That was based on the original data that  
19 we generated --

20 Q. Okay.

21 A. -- and I had a hundred percent access  
22 to.

23 Q. When teaching and advising your students  
24 at VCU, do you recommend they use photocopied  
25 images for FFT analysis?

1       A.    Not if we want reproducible results so  
2 we can compare one scaffold to another  
3 side-by-side.

4       Q.    In your declaration, you stated that you  
5 used the Lee provisional Figure 1-D because it had  
6 higher quality images than the nonprovisional Lee  
7 publication. Is that correct?

8       A.    Yes.

9       Q.    Did you perform FFT analysis of the  
10 nonprovisional Figure 1-D?

11       A.    I looked at it and made a judgment that  
12 it probably wasn't suitable.

13       Q.    Was that before or after you ran FFT  
14 analysis?

15       A.    I never ran FFT analysis.

16       Q.    You did not? Okay.

17       A.    No.

18       Q.    So that's what I'm asking.

19       A.    Yeah. It was just a -- visual  
20 inspection told me it would not be particularly  
21 helpful.

22       Q.    So if you could look at Figure 1-D from  
23 the Lee nonprovisional, Exhibit 8, as compared to  
24 Figure 1-D from the provisional, Exhibit 9, once  
25 you've got those ready, I'd like to ask you a

1 question.

2 A. Okay.

3 Q. In what way is the provisional  
4 Figure 1-D higher quality than the nonprovisional?

5 A. There's more information. There are  
6 more lines for the FFT to detect.

7 Q. What do you mean by "lines"?

8 A. More -- I'm sorry, not lines. More  
9 edges for the FFT to detect.

10 Q. Would you characterize the provisional  
11 Figure 1-D as a high quality image?

12 A. Higher than the actual patent  
13 application, yes.

14 I notice also as a part of my visual  
15 inspection of Panel 1 -- Figure 1-D there, fibers  
16 don't even -- are not even resolved in this image  
17 so that they traversed the entire distance of the  
18 image.

19 Q. Which figure are you referring to --

20 A. I'm looking at.

21 Q. -- the provisional or nonprovisional?

22 A. Nonprovisional. It's a -- it's a very  
23 low data image with a lot of background.

24 Q. And then turning to the provisional  
25 application that you used, Lee's Figure 1-D, the

1 provisional, Exhibit 9, compare that to the images  
2 you've used in your Ayres papers. In what way do  
3 the image qualities vary?

4 A. Comparing D to work that we did in the  
5 past?

6 Q. Yes.

7 A. Well, I assume that the original data  
8 image is equivalent, and this is just a Xerox of a  
9 print, so it's -- it's not as clean looking as the  
10 original data image. But it's certainly a lot  
11 cleaner and has more information in it than in the  
12 nonprovisional patent. I could only work with  
13 what was available.

14 Q. Do you normally perform FFT analysis  
15 with images that approximate the quality of the  
16 Lee provisional, Figure 1-D?

17 A. It's less than satisfactory, but it's  
18 perfectly valid.

19 Q. Do you normally perform FFT analysis  
20 with images that approximate the quality of the  
21 Lee provisional?

22 A. No.

23 Q. Do you know in what way the Lee  
24 provisional, Figure 1-D, was stored --

25 A. I --

1 Q. -- and/or compressed?

2 A. I have no idea.

3 Q. Do you know what version of the ImageJ  
4 software you utilized to perform your FFT  
5 analysis?

6 A. It would have been the same version that  
7 I did to do the Huang image.

8 Q. And do you know what that was?

9 A. We didn't -- we didn't know what that  
10 is, I don't think. I -- I -- I would have thought  
11 we recorded it.

12 Q. If you -- would you like to take a  
13 minute to look at your --

14 A. Yeah, take a peek. I would have thought  
15 we recorded it.

16 Q. Is it important to know the version?

17 A. No, it's not.

18 No, all I can report is that it was the  
19 latest version that was available when this  
20 project started, and I downloaded it fresh from  
21 the NIH site.

22 Q. So we've discussed the image you used  
23 for testing for Lee.

24 What steps did you take to create a 2D  
25 FFT output image?

1 A. From Lee.

2 Q. So you said -- yeah, you said --

3 A. From Lee.

4 Q. -- took a sample from the middle of the  
5 Lee provisional, Figure 1-D.

6 A. Yeah.

7 Q. You trimmed that?

8 A. I did.

9 Q. And then what did you do?

10 A. Put a mask on it, processed the FFT.

11 Q. Where do you discuss putting a mask on  
12 it?

13 A. It's not in the document.

14 Q. So you applied a mask to Lee, but  
15 didn't --

16 A. I follow --

17 Q. -- disclose that?

18 A. I followed Ayres' technique.

19 Q. Okay. Let's back up then.

20 Looking at what's marked as Exhibit 1,  
21 the declaration from your '248 IPR --

22 A. I got it.

23 Q. -- at paragraph 188, which is on  
24 page 81. Once we're on the same page, let me  
25 know.

1 A. Okay.

2 Q. Okay. So you say: I conducted my own  
3 analysis on Lee's Figure 1-D using the FFT  
4 analysis described in the '223 Patent.

5 A. Uh-huh.

6 Q. And on the prior page at paragraph 184,  
7 we see the Lee provisional Figure 1-D.

8 Where is an image showing your placement  
9 of the mask?

10 A. We didn't feel the need to do that.

11 Q. Where in your report do you discuss  
12 applying a mask to Lee?

13 A. I'm sure it's -- I would have thought it  
14 was here, but it's not. It -- I'm just following  
15 the published method, putting a mask on.

16 Q. So earlier we looked at the Ayres 2006  
17 paper, and you agreed that it does not disclose  
18 using a mask. Is that correct?

19 A. The 2008 paper does. The 2006 paper  
20 uses only SEMs of very high quality, and there's  
21 very little noise in an image like that. The 2008  
22 paper uses some bright-field microscopy, which is  
23 a very noisy technique.

24 The noisiness of the image resembles in  
25 a lot of way the -- ways the kind of noise that

1 appears in this Lee image that is so degraded by  
2 being Xeroxed.

3 And so as -- as a practitioner, my  
4 judgment was -- the best way to get an image that  
5 was of use was to use a mask.

6 Q. Let's turn to your 2008 Ayres paper,  
7 which is marked as Exhibit 4.

8 A. Okay. I got it.

9 Q. And we'll turn to page 615 when you're  
10 able.

11 A. Okay. Okay.

12 Q. And I'm looking at the -- the third  
13 paragraph, the paragraph begins with "As noted,"  
14 but I'm going to jump ahead to about two-thirds of  
15 the way through the paragraph.

16 The sentence says: Processing the image  
17 with a window mask removes the spurious  
18 information without altering the height of the  
19 alignment. Although this type of mask can be  
20 useful in many applications, it reduces the total  
21 surface area available for analysis.

22 In view of that sentence, do you read  
23 the Ayres 2008 paper as requiring the use -- use  
24 of a mask?

25 A. No.

1 Q. Okay. So after you applied your mask to  
2 Lee provisional Figure 1-D, what did you do next?

3 A. I ran the FFT from ImageJ to produce the  
4 spectrum.

5 Q. Did you apply the circular projection?

6 A. I did. It's the only kind of projection  
7 that I know of of being able to put on there to do  
8 an oval summation.

9 Q. And where did you apply the projection?

10 A. As in Huang 2, I allowed the circle to  
11 be tangent with the edges of my square.

12 Q. And is that documented anywhere?

13 A. No.

14 Q. Your FFT plot disclosed in your report,  
15 for example, paragraph 188 of what's marked as  
16 Exhibit 1, it reports the y-axis with gray value  
17 data?

18 A. Yes.

19 Q. Did you normalize this data?

20 A. I chose not to.

21 Q. Why not?

22 A. I wasn't comparing it to any other  
23 specific scaffold, I was just demonstrating that  
24 there are two symmetric peaks. I don't have to  
25 normalize it to accomplish that.

1 Q. Earlier in discussing the Huang  
2 reference, you stated that you did normalize the  
3 data?

4 A. In Huang.

5 Q. And why? Were you comparing Huang to  
6 any other scaffold?

7 A. I was comparing Huang to Huang to show  
8 that there were two peaks in the Huang plot, one  
9 of which was not present because -- in the  
10 publication because he only mapped it to  
11 180 degrees. I mapped it to 360.

12 In this case, I'm just demonstrating  
13 that an FFT shows two prominent peaks consistent  
14 with a high degree of alignment, and consistent  
15 with Lee's report that he had anisotropic  
16 mechanical properties, he had images that showed  
17 the fibers were aligned, he had placed cells on  
18 the scaffold and they were aligned, and he had  
19 done his angle measurements to show that the  
20 principal -- the principal orientation of the  
21 fibers through the image were from top to bottom.

22 Q. From what paragraph are you --

23 A. I am --

24 Q. -- referencing?

25 A. I am summarizing the results of his

1 data.

2 Q. Whose data?

3 A. Lee's data.

4 Q. Okay. And what I'm trying to understand  
5 is why you elected to normalize and report  
6 normalized intensity value for Huang but not for  
7 Lee?

8 MR. LEVINE: Objection. Asked and  
9 answered.

10 THE WITNESS: Wasn't necessary. I  
11 wasn't comparing it to anything. I was only  
12 demonstrating a Lee FFT plot that an aligned  
13 scaffold, by all those other criteria, would  
14 have two symmetric peaks about 180 degrees  
15 apart from one another.

16 BY MS. WIEKER:

17 Q. So I'd like to summarize what I think  
18 you've testified to regarding your -- your  
19 personal testing of Huang 2 and Lee, and please  
20 correct me if I'm incorrect.

21 For both the Huang 2 and Lee testing,  
22 you applied a mask to the image; is that correct?

23 A. I did.

24 Q. Okay. Okay. I think we're done with  
25 the Lee document for now.

1 THE WITNESS: Since we're at a natural  
2 break, I'm going to run to the bathroom  
3 again --

4 MS. WIEKER: Okay.

5 THE WITNESS: -- being 67.

6 MS. WIEKER: We'll take a break from the  
7 record, please.

8 THE VIDEOGRAPHER: The time is  
9 2:16 p.m., we are now off the record.

10 (Recess taken at 2:16 p.m., proceedings  
11 resumed at 2:23 p.m.)

12 THE VIDEOGRAPHER: Time is 2:23 p.m., we  
13 are now on the record.

14 BY MS. WIEKER:

15 Q. Dr. Simpson, are you familiar with the  
16 concept of elastic modulus?

17 A. Probably under some other name; but  
18 proceed.

19 Q. Well, let me ask it differently.  
20 Would you -- how would you describe a  
21 materials resistance to deformation by an applied  
22 force?

23 A. Oh, okay. I see what you're -- I see  
24 where you're going. I would have called that the  
25 elastic modulus; it's how much force is required

1 to overcome a static object.

2 Q. Okay. Is that also colloquially  
3 referred to as, like, a measure of material  
4 stiffness?

5 A. Yes.

6 Q. Would a material with a higher elastic  
7 modulus indicate that the material is stiffer  
8 compared to a material with a lower elastic  
9 modulus?

10 A. It would.

11 Q. Do you agree that different types of  
12 tissue have a different elastic moduli?

13 A. I do.

14 Q. Would that be within the knowledge of a  
15 person of skill in the art?

16 A. Would that specific piece of information  
17 be available to a person skilled in the art? I  
18 would expect so.

19 Our students try to calibrate their  
20 constructs to some specific tissue that they were  
21 working on. My partner's lab was a materials  
22 testing lab, so they were very big on that.

23 Q. So would you expect the elastic modulus  
24 for skin tissue to differ from that of tendon  
25 tissue?

1 A. Native tissue, yes.

2 Q. Okay. Do you know the relative  
3 difference between skin tissue and tendon tissue?

4 A. No.

5 Q. Could you approximate whether skin  
6 tissue would have a higher, lower, or the same  
7 elastic modulus as that of tendon?

8 A. I would guess that it is -- it's --  
9 it's -- it's more easily stretched, so a lower  
10 modulus.

11 Q. And you're saying a lower modulus for  
12 skin tissue?

13 A. Yes.

14 Q. Okay. What are the relative loads being  
15 borne by skin tissue as compared to tendon tissue?

16 A. I have no idea. It would vary by the  
17 tendon under consideration, and it would vary by  
18 where you are in the body with respect to the  
19 skin.

20 Q. Okay. So would -- what loads are being  
21 borne by the achilles tendon, for example?

22 A. I have no idea.

23 If you're asking me to put a number on  
24 the number of Newtons that are there, I have no  
25 idea.

1 Q. No, I'm not asking for a specific  
2 number. I was asking for the relative loads being  
3 borne by the two structures.

4 MR. LEVINE: Objection to foundation.

5 BY MS. WIEKER:

6 Q. Do you agree that tendon bears a load?

7 A. I do.

8 Q. Do you agree that skin tissue bears a  
9 load?

10 A. I do.

11 Q. Okay. Do you have an opinion as to  
12 which would be higher?

13 MR. LEVINE: Objection to foundation.

14 THE WITNESS: I'm really only guessing.

15 Tendon is --

16 MR. LEVINE: You don't have to.

17 THE WITNESS: Okay.

18 MR. LEVINE: I -- I don't think she  
19 wants you to guess.

20 THE WITNESS: Okay. That's all I can do  
21 is guess. I don't have specific numbers in  
22 my head.

23 BY MS. WIEKER:

24 Q. Are you familiar with the biological and  
25 material properties of engineered tissue

1 scaffolds?

2 A. I understand how to test them, but every  
3 scaffold would be unique from its composition.

4 Q. If a person of skill in the art were  
5 developing scaffold for repairing a specific type  
6 of native tissue, is it important to match or  
7 mimic the mechanical properties of that native  
8 tissue?

9 A. The profession believes so, yes.

10 Q. Do you disagree?

11 A. No.

12 And "mimic" is a very broad term because  
13 there are -- there are other considerations  
14 involved there besides just the material  
15 properties. But that is certainly one parameter.

16 Q. So would you agree that a person of  
17 skill in the art would attempt to match the  
18 elastic modulus of the native tissue to their  
19 engineered tissue scaffold?

20 MR. LEVINE: Objection. Foundation.

21 THE WITNESS: Or likely exceed.

22 BY MS. WIEKER:

23 Q. What do you mean by "or likely exceed"?

24 A. When designing a tissue implant, the  
25 theory goes that you have to start with one

1 material property knowing that that material  
2 property will likely change over time, and the  
3 trick has been to judge allowing the implant to  
4 exist long enough to sustain the mechanical forces  
5 it's experiencing as it develops.

6 The perfect example of this is in an ACL  
7 injury, they use a cadaveric donor to fix the ACL,  
8 and it works pretty well, the initial stages of  
9 the surgery give pretty good results, and then  
10 there's a dip in the mechanical forces just before  
11 a full recovery occurs, and then they climb again.

12 You don't want the material properties  
13 to be such that they fail before they -- the  
14 structure has a chance to make that second climb  
15 for the ACL.

16 So it's always been a game of trying to  
17 decide what is the ideal mechanical load. We  
18 don't know.

19 Q. What would happen if the elastic modulus  
20 of the scaffold was lower than the elastic modulus  
21 of the native tissue?

22 A. Lower than the native tissue?

23 Q. Correct.

24 A. It would depend on the tissue. I mean,  
25 it could be anything.

1 Q. Would you recommend that a person of  
2 skill in the art design a tissue scaffold that was  
3 a hundred percent lower elastic modulus than that  
4 of the native tissue?

5 MR. LEVINE: Objection. Foundation.

6 THE WITNESS: All I can say is that we  
7 successfully reconstructed skin using a  
8 material that was approximately like tissue  
9 paper and couldn't be sutured. It depends on  
10 the tissue. It depends on the application.  
11 It depends on the operator.

12 BY MS. WIEKER:

13 Q. Well, then let's talk about the specific  
14 tissues in some of the claims here, for example.

15 Would you recommend that a person of  
16 skill in the art -- strike that.

17 Would you design a scaffold for ACL  
18 repair, for example, like you mentioned that has  
19 an elastic modulus that is a hundred percent lower  
20 than the native tissue?

21 A. Would I? I might. It all depends on  
22 what the healing response is going to be.

23 Q. Do you --

24 A. I can immobilize my patient so they're  
25 not using the joint to allow it to recover. It

1 doesn't have to match the exact material  
2 properties at the time you put it in.

3 Q. Right. And I'm not asking about a  
4 hundred percent matching.

5 A. Uh-huh.

6 Q. I'm just saying --

7 A. I know a hundred percent less.

8 Q. Uh-huh.

9 A. I -- I don't know. I -- I -- whatever  
10 works.

11 MS. WIEKER: Mr. Levine, is there  
12 something --

13 MR. LEVINE: No. No.

14 BY MS. WIEKER:

15 Q. So when do you know what the healing  
16 response is going to be?

17 MR. LEVINE: Objection to the form of  
18 the question. Objection. Foundation.

19 BY MS. WIEKER:

20 Q. Dr. Simpson, did you testify a moment  
21 ago that whether you would apply a certain  
22 scaffold "all depends on what the healing response  
23 is going to be"?

24 A. Yes.

25 Q. Do you ever know what the healing

1 response will be?

2 A. Not until you do experiments to discover  
3 what it is.

4 Q. So at the initial stages when crafting  
5 your experiment, would you design a scaffold that  
6 is 100 percent lower than the elastic modulus of  
7 the tissue to be repaired?

8 MR. LEVINE: Objection. Asked and  
9 answered. Objection. Foundation.  
10 Objection. Form.

11 THE WITNESS: I -- you know, you  
12 could -- you could pick any number out of  
13 your hat. It could be 1 percent of the  
14 original material properties and successfully  
15 repair it. You don't -- I don't know. You'd  
16 have to do experimentation to determine it  
17 for the -- your scaffold system or for your  
18 tissue system.

19 BY MS. WIEKER:

20 Q. Is elastic modulus a property that would  
21 be considered in designing a tissue scaffold?

22 A. I suppose.

23 Q. Have you designed tissue scaffolds?

24 A. Yes.

25 Q. Did you consider elastic modulus?

1       A.    I liked stress measurements.  Stress of  
2 failure.

3       Q.    Did you consider elastic modulus?

4       A.    I suppose Gary's lab explored that and  
5 used that.  I don't know.

6       Q.    Who is Gary's lab?

7       A.    Gary was my business/scientific partner  
8 for 20 years.

9       Q.    So you personally never considered  
10 elastic modulus in designing a tissue scaffold?

11      A.    No, not a specific value.  No.

12      Q.    Did you consider the concept of elastic  
13 modulus in designing a tissue scaffold?

14      A.    I considered the -- no.  No.

15      Q.    Did you consider any mechanical  
16 properties other than stress?

17      A.    Strain to some extent.  But those two  
18 are related, and you get that as two pieces of  
19 information at the same time.

20      Q.    Did you consider any other properties  
21 besides stress or strain?

22      A.    Mechanical testing properties?  I  
23 didn't.  Uh-uh.

24      Q.    Did you consider degradation rate of  
25 your tissue scaffold?

1 A. Absolutely.

2 Q. Do you agree that stability is important  
3 when designing an electrospun collagen scaffold?

4 MR. LEVINE: Objection to the form of  
5 the question.

6 THE WITNESS: Are we -- it -- the -- the  
7 time it takes something to disintegrate is  
8 entirely dependent on, again, the healing  
9 response of the tissue under consideration.

10 I might not want a tendon implant to  
11 disappear in a day, but I might want a blood  
12 clot that I'm trying to produce in an injury  
13 to disappear in a day.

14 BY MS. WIEKER:

15 Q. In Huang 2, at page 1791, Huang 2 is  
16 Exhibit 6. I think it's there in your left-hand  
17 pile.

18 A. Is it? You saw it? Thank you.

19 Q. Just keep going. There you go.

20 A. Oh, there's another one under there.

21 Q. It's that one you got.

22 A. 1796?

23 Q. 1792?

24 A. 92.

25 Q. 91?

1 A. 91.

2 Q. I'm sorry.

3 A. 1791.

4 MR. LEVINE: So the -- the cover page,  
5 is that 1791?

6 MS. WIEKER: No. The --

7 THE WITNESS: You got a different one.

8 MR. LEVINE: Oh, that may be why. Take  
9 a look.

10 THE WITNESS: 1791 was the -- was the  
11 front page.

12 MR. LEVINE: Right.

13 MS. WIEKER: Under the introduction and  
14 before "Materials" and that --

15 MR. LEVINE: Yeah.

16 BY MS. WIEKER:

17 Q. Okay. So the right column on 1791,  
18 Huang 2 says -- this is in the second paragraph,  
19 partway through: To better mimic skin ECM,  
20 electrospun collagen fibers have been fabricated;  
21 however, the rapid degradation and poor mechanical  
22 properties determine that either cross-linking or  
23 combination with other materials is necessary to  
24 obtain a stable scaffold.

25 Do you agree with that statement?

1 A. I do.

2 Q. Okay.

3 A. But it can be both. It doesn't have to  
4 be one or the other, it can be both.

5 And, in fact, if you don't cross-link  
6 collagen when you put it into water, it instantly  
7 disappears.

8 Q. You agree with the statement I read from  
9 Huang 2?

10 A. I agree with it, and just extend it to  
11 say that there's no reason you can't cross-link a  
12 collagen PCL scaffold.

13 Q. Are you familiar with PCL?

14 A. I'm not an expert. I'm familiar enough  
15 with the chemistry to know a little bit.

16 Q. Do you have an opinion as to the  
17 relative stability of PCL compared to collagen?

18 A. PCL is probably, depending on the form,  
19 weeks to months or even longer, again depending on  
20 the form, if it's a block versus a fiber.

21 And the collagen is the same, it could  
22 be -- it could be instantaneous dissolution by  
23 putting it into a saline solution after you  
24 electrospin it, and it could be probably on the  
25 order of -- it's hard to say, may -- in -- in

1 tissue culture, it would last a long time. I  
2 don't think it would last months, but it would  
3 last quite a long time in tissue -- in a tissue  
4 culture environment.

5 Q. So in your answer you said, "PCL is  
6 probably, depending on the form, weeks to months  
7 or even longer."

8 What do you mean by "weeks to months"?

9 Is that a measure of the time to  
10 degradation?

11 A. That's -- yes, that's a measure -- it's  
12 the physical form that would -- would determine  
13 that rate.

14 Q. So then it's -- tell me if you disagree.  
15 It sounds like if PCL is weeks to months or even  
16 longer, and you testified that collagen could  
17 dissolve instantly --

18 A. Without --

19 Q. -- in saline solution.

20 A. Without cross-linking.

21 Q. Right. I'm just asking --

22 A. Uh-huh.

23 Q. -- about pure collagen, not  
24 cross-linked.

25 A. Uh-huh.

1 Q. It sounds like you agree that they  
2 differ, the relative stabilities?

3 MR. LEVINE: Objection to the form of  
4 the question.

5 THE WITNESS: Your -- I would say  
6 that -- I will go as far to say that when PCL  
7 is implanted that it degrades as a  
8 consequence of hydrolysis, it's a very --  
9 a relatively very passive process because  
10 it's just sitting in tissue fluids.

11 Collagen, on the other hand, does not  
12 dissolve just because you put it in tissue  
13 fluids. Collagen dissolves because cells  
14 will invade it and degrade it.

15 It's two different -- it's two different  
16 processes; one's an active proteolytic driven  
17 one, which can be very quick or very slow  
18 depending where the collagen is, and the  
19 other is just you put PCL in water, and  
20 eventually it's going to dissolve.

21 BY MS. WIEKER:

22 Q. Is PCL hydrophobic or hydrophilic?

23 A. Oh, my. It's a lactone. I believe it's  
24 pretty -- I think -- I'm -- I'm only guessing. I  
25 think it's relative --

1 Q. You don't need to guess.

2 A. Yeah, I'm only guessing. I -- I -- I  
3 have a good guess, but it's a guess.

4 Q. You don't -- you don't need to guess.

5 A. Thank you.

6 Q. Is the stability of PCL and pure  
7 collagen, not cross-linked collagen, are those  
8 knowable by researching appropriate references  
9 that one of skill in the art would have access to?

10 A. I believe that it would be available,  
11 yes. People study that.

12 Q. Do you agree that there are  
13 disadvantages to cross-linking?

14 MR. LEVINE: Objection to the form of  
15 the question.

16 THE WITNESS: Disadvantages? In the  
17 case of collagen, unless you cross-link, the  
18 collagen is just going to go back to being a  
19 dissolved protein. So there is a serious  
20 disadvantage to not cross-linking it in some  
21 way.

22 BY MS. WIEKER:

23 Q. Do you disagree then with Huang's  
24 statement that you can either cross-link or blend?

25 A. That you can either cross-link or blend,

1 or do both, I agree with his statement, but that  
2 does not mean that you can't do both, and it does  
3 not mean it wouldn't be desirable to do both.

4 Q. I -- that's not my question.

5 My question is, do you disagree with the  
6 statement I read from Huang 2 which says: The  
7 rapid degradation and poor mechanical properties  
8 determine that either cross-linking or a  
9 combination with other materials is necessary to  
10 obtain a stable scaffold?

11 MR. LEVINE: Objection. Asked and  
12 answered.

13 THE WITNESS: I -- he falls one short  
14 there, but I agree with the statement. You  
15 have to do either/or and.

16 BY MS. WIEKER:

17 Q. And then is it your testimony that  
18 without cross-linking, a collagen will  
19 disintegrate immediately?

20 A. It is not.

21 Q. Okay. What will happen without  
22 cross-linking to a PCL collagen blend?

23 A. It will dissolve substantially at the  
24 rate at which pure PCL will dissolve. A little  
25 faster, because it has the contaminating collagen

1 in it.

2 The collagen -- as the PCL fibers sit in  
3 water, collagen exists in two compartments;  
4 there's collagen on the surface of the molecule,  
5 there's collagen inside the molecule, it all  
6 depends on -- you know, you never know what you're  
7 going to get in those circumstances, but the  
8 surface collagen dissolves away from the PCL  
9 fiber, the collagen that's imbedded in the PCL  
10 sticks around for a while, and as the PCL  
11 degrades, the collagen that is trapped in the PCL  
12 is liberated and dissolves away.

13 Collagen PCL is not technically a  
14 copolymer. It's not that PCL's bound to collagen  
15 in any way.

16 MS. WIEKER: I'd like to mark -- I think  
17 we're on Exhibit 10.

18 (Simpson Deposition Exhibit 10 marked  
19 for identification.)

20 THE WITNESS: Thank you.

21 BY MS. WIEKER:

22 Q. Do you recognize this publication?

23 A. I do. That's my Gary.

24 Q. You're referencing Gary Bowlin --

25 A. Gary Bowlin.

1 Q. -- in the, yeah, the authorship?

2 Did you coauthor this paper?

3 A. I did.

4 Q. Would you have published this paper if  
5 you knew anything in it to be inaccurate?

6 A. No. That's not the way we do science.

7 Q. Would you consider this paper to be a  
8 reliable source of information for a person of  
9 skill in the art?

10 A. Because it came from us, yes,  
11 especially.

12 Q. So I'm going to reference the page  
13 numbers printed at the bottom. You can turn to  
14 page 1594.

15 A. Which is at the top.

16 Q. Oh, sorry. It's -- I promise it's at  
17 the bottom on the page -- the first page.  
18 Page 1594, the left-hand column.

19 A. Uh-huh.

20 Q. Would you read the sentence that starts  
21 that first full paragraph?

22 A. Where it says "Cross-linking"?

23 Q. Uh-huh.

24 A. Excuse me.

25 Cross-linking can be used to tailor

1 degradation rate and bio -- biomechanical  
2 characteristically -- characteristics, typically  
3 to match those characteristics of the tissue  
4 designated for regeneration, but it may compromise  
5 biocompatibility.

6 The --

7 Q. Okay. You can stop there.

8 A. Okay.

9 Q. Do you agree that biocompatibility is an  
10 important characteristic of a tissue scaffold?

11 A. I would say that it is important.

12 Q. Is it disadvantageous to compromise  
13 biocompatibility?

14 A. Well, certainly if you implant something  
15 that causes a massive rejection, that would be  
16 bad.

17 Q. Okay. Further down in that same  
18 paragraph, I don't know, like seven lines down,  
19 you'll see a list of what the paper describes,  
20 "popular chemical cross-linking agents."

21 A. Uh-huh.

22 Q. And it refers to glutaraldehyde.

23 A. Uh-huh.

24 Q. The -- the sentence goes on to state  
25 that: These popular chemical cross-linking agents

1 have "been shown to be cytotoxic because --  
2 because of the reactive moieties that are  
3 covalently coupled between neighboring collagen  
4 fibrils."

5 Did you read that?

6 A. Actually, I'm -- I was looking where it  
7 says -- are you at where it says --

8 Q. Yeah, that --

9 A. -- 2023 there?

10 Q. -- that sentence before it.

11 A. Right -- oh, before that. Okay. That  
12 helps.

13 Q. If you go four lines up from that  
14 reference site, you'll see "popular chemical  
15 cross-linking agents" --

16 A. Okay. I see it.

17 Q. -- including several --

18 A. Thank you. I see that.

19 Q. Okay.

20 A. Okay. Tissue [reading].

21 Okay. I'm --

22 Q. Okay.

23 A. I'm up -- I'm up to speed on that now.

24 Q. What is cytotoxicity?

25 A. You can think of that as something that

1 could kill a cell.

2 Q. Okay. Is cytotoxicity problematic for a  
3 tissue scaffold that would be implanted in a  
4 patient?

5 A. You would think so, but usually you do  
6 your best to eliminate most of that by incubating  
7 the material with blocking agents that absorb all  
8 the reactive sites.

9 Q. Do you disagree with the statement that  
10 these popular chemical cross-linking agents have  
11 been shown to be cytotoxic?

12 A. Any of them at a enough -- high  
13 enough -- I'm sorry. Any of those at a high  
14 enough concentration could be cytotoxic, yes.

15 Q. Okay. The -- staying in the same  
16 paragraph, right after that citation to 20 to 23,  
17 there are two sentences talking about  
18 glutaraldehyde.

19 And in that last sentence of the  
20 paragraph it says: It is the most commonly used  
21 and accepted agent for the cross-linking of  
22 biological tissues, but it has also been  
23 implicated in the development of calcification.

24 A. Uh-huh.

25 Q. What is calcification?

1       A.    I think what this is referring to under  
2   these circumstances, if you use a cross-link  
3   material -- and this likely comes -- just let me  
4   look at the references.

5                So Reference 24 -- I'm sorry. That was  
6   middle age -- 21.

7                And 24, interesting in their title.

8                21 says: Glutaraldehyde is a fixative  
9   in bioprotheses and drug delivery matrixes.

10              Now, I have no idea what is in that  
11   paper, but from that title I would presume that  
12   they are discussing using cadaveric materials to  
13   replace tissues, and one of the things you do in  
14   those circumstances is to use glutaraldehyde to  
15   stabilize it and to -- and to paralyze it -- to  
16   sterilize it.

17              And 24, the title of that particular  
18   paper also tells me that this is for a piece of  
19   tissue, acellular vascular tissues. There was a  
20   time when people were trying to take blood vessels  
21   and denude them of all -- all signs of cellular  
22   material, and then fixing them, and then  
23   attempting to use them as blood vessels.

24              And the last reference there, 25:  
25   Evaluation of collagen cross-linkage for the

1 stabilization of tissue matrixes.

2 And that's probably looking at some kind  
3 of collagen, some kind of -- 1993. That would be  
4 before electrospinning occurred, that was --  
5 that's most likely a collagen hydrogel, which is  
6 actually very different than electrospun collagen.  
7 Even though it is a collagen material, you can  
8 take those kinds of collagens and put them in  
9 water and they don't dissolve.

10 So back to the reference you asked  
11 about. "It is most -- it is the most commonly  
12 accepted -- used and accepted agent for cross --  
13 the cross-linking of biological tissues, but also  
14 have been implicated in the development of  
15 calcifications."

16 I would guess that what's happening is,  
17 for example, in these cadaveric ACLs, the risk of  
18 having the glutaraldehyde present just acts as a  
19 signal for probably the tenocytes to deposit  
20 collagen.

21 I mean, that happens in -- in all of us  
22 as we age. It's why people that are 60 lose their  
23 achilles tendons, they get calcified. The tendon  
24 starts to think it wants to be a bone.

25 So I think that's what they're referring

1 to there, mostly, is that the glutaraldehyde can  
2 accelerate or nucleate the deposition of calcium  
3 in the -- in the tissue that you've implanted.

4 Q. Is the development of calcification in a  
5 tissue scaffold a good thing or a bad thing, or  
6 neither?

7 A. That's a nice question.

8 Well, obviously if you're making bone,  
9 that would be a very positive thing, to have  
10 calcification occur through collagen. Bone is  
11 nothing more than Type I collagen with calcium  
12 mixed in with it.

13 In other tissues, it would -- it would  
14 reduce the -- probably -- it would probably reduce  
15 the elasticity, and that might cause a problem.

16 So I would say on the balance, it  
17 probably doesn't matter that much.

18 Q. The next paragraph, it begins with "Our  
19 laboratory," but I'm going to jump towards --

20 A. Uh-huh.

21 Q. -- two-thirds of the way down.

22 And -- and feel free, if you need to  
23 read up to the area I'm skipping, just let me  
24 know, and we'll do that.

25 But there's a sentence that starts with

1 "To avoid this."

2 A. Uh-huh.

3 Q. To avoid this, our laboratory has  
4 previously electrospun blends of collagen with  
5 synthetic polymers, which has proven successful in  
6 initial cell studies, but it is desirable to be  
7 able to work with collagen only electrospun  
8 scaffolds for such applications as cartilage  
9 tissue engineering. Thus, the complimentary  
10 exogenous cross-linking agent is required if pure  
11 collagen electrospun scaffolds are to be used as  
12 tissue engineering scaffolds.

13 So I just want to confirm that initial  
14 sentence, your laboratory has previously  
15 electrospun blends of collagen with synthetic  
16 polymers, which has proven successful in initial  
17 cell studies. Is that accurate?

18 A. Yes.

19 Q. Okay. Okay. That's all I have on that  
20 exhibit.

21 I'd like to ask you a question about  
22 electrospun fibers. What is a sheet of  
23 electrospun fibers?

24 A. I'm sorry, I was reading the next  
25 paragraph down, because we certainly explored

1 cross-linking all scaffolds.

2 Would you please ask -- ask again?

3 Q. Of course.

4 A. I'm sorry.

5 Q. What is a sheet of electrospun fibers?

6 A. An extended flat surface.

7 Q. Okay.

8 A. It's not a cube, it's not a circle.

9 Q. All right.

10 MS. WIEKER: So I think this will be --

11 THE REPORTER: 11.

12 MS. WIEKER: 11.

13 (Simpson Deposition Exhibit 11 marked  
14 for identification.)

15 MR. LEVINE: Thank you.

16 BY MS. WIEKER:

17 Q. Dr. Simpson, do you recognize this  
18 publication?

19 A. I have not read this particular  
20 publication, I don't think. Looking through it  
21 here just to see. This is -- this is Vacanti. He  
22 didn't use it in the document very much.

23 Q. So can I draw your attention to your  
24 Exhibit A of your declaration --

25 A. Yeah.

1 Q. -- where -- as Exhibit Number 1014, you  
2 cite to U.S. Patent Number 5,514,378.

3 A. Oops. I'm sorry, I'm in the wrong one,  
4 1014? 10 -- oh, Mikos -- Mikos? Yes. All right.  
5 I can answer questions.

6 Q. Have you read this?

7 A. I have not read this in great detail.  
8 As I recall, I didn't think it was particularly  
9 relevant.

10 Q. But you relied upon it in your  
11 declaration; is that correct?

12 A. I read a lot of things in my -- for my  
13 declaration. And I had to make choices about what  
14 to use and what not to use.

15 Q. Okay. So let's see. So if I point you  
16 to paragraph 204 of your ' '248 Declaration, which  
17 is marked as Exhibit 1 --

18 A. 204?

19 Q. Uh-huh. I think that will refresh your  
20 recollection.

21 A. 204, 204.

22 Q. It's on page 84?

23 A. Okay. I'm there.

24 I see why this received scant attention  
25 because it's a reference.

1 Q. I'm sorry, it's because what?

2 A. It's a reference from Lee.

3 Q. So in your declaration, paragraph 204,  
4 you state: Lee incorporates Mikos by reference,  
5 which describes the salt leeching process in  
6 greater detail?

7 A. Yes, I see that.

8 Q. Okay. So do you -- you recall this  
9 discussion of the reference?

10 A. Yeah, it's manipulating the scaffold  
11 porosity by either incubating or electrospinning  
12 salts into a scaffold, this has been used for a  
13 long time, and then extracting the salt by  
14 dissolving it out. And the theory is is that you  
15 leave holes and you leave voids in the material  
16 that you salt leached --

17 Q. Okay.

18 A. -- when the salt leaves, yes.

19 Q. Okay. Would you consider this paper to  
20 be a reliable source of information for a person  
21 of skill in the art?

22 A. Especially coming from this laboratory,  
23 yes.

24 Q. Okay. Is salt leeching compatible with  
25 collagen or collagen blended scaffolds?

1 A. I don't see why not.

2 There's so much void space, there's so  
3 much open space in electrospun material that  
4 usually there's no reason to do anything to it.

5 MS. WIEKER: All right. Can we mark  
6 Exhibit 12, please.

7 (Simpson Deposition Exhibit 12 marked  
8 for identification.)

9 MR. LEVINE: Thank you.

10 BY MS. WIEKER:

11 Q. Do you recognize this publication?

12 A. I do.

13 Q. Would you consider this paper to be a  
14 reliable source of information for a person of  
15 skill in the art?

16 A. Yes.

17 Q. I'd like to draw your attention to  
18 paragraph 112, which is on the second-to-last  
19 page, printed page.

20 A. I'm there.

21 Q. Okay. The last sentence -- are you  
22 okay?

23 A. Just got a -- I -- I got a cramp, that's  
24 all. It's -- no, go ahead. I'm fine. I'm fine.

25 Q. Okay. Okay.

1 A. It's just a cramp.

2 Q. The last sentence of paragraph 112 says:  
3 This design avoids poor cell seating throughout  
4 the scaffold that is a major limitation of aligned  
5 scaffolds due to their low porosity as a result of  
6 closely packed aligned fibers.

7 A. I see that.

8 Q. Do aligned scaffolds suffer from low  
9 porosity as a result of closely packed aligned  
10 fibers?

11 MR. LEVINE: Objection. Asked and  
12 answered.

13 THE WITNESS: There's -- it's always  
14 entertaining to see people's philosophies.

15 No scaffold supports much cell  
16 infiltration, regardless of the pore size and  
17 tissue culture. This design avoids poor cell  
18 seating throughout the scaffold, which is  
19 what they want to do. Major limitation of  
20 the line scaffold is due to their low  
21 porosity.

22 Yes, but they have very large pore  
23 sizes, which, theoretically, should allow  
24 cells to get in.

25 You have to think about if you have a

1 column of fibers, any space between the two  
2 adjacent columns represents a pore. And I  
3 think that the low porosity comment there --  
4 you know, I would say that's a very general  
5 comment, and I'm presuming that it is  
6 directed at whatever spinning conditions  
7 they're using here.

8 BY MS. WIEKER:

9 Q. So you disagree with the statement, the  
10 general comment, as you determined, that low --  
11 low porosity results from closely packed aligned  
12 fibers?

13 A. Yeah, I'd like to read that whole  
14 paragraph.

15 Q. Of course. Take a moment.

16 A. Give me a moment, please.

17 I'm -- I'm not trying to be difficult.

18 I am not trying to be lawyerly in the least.

19 All of the discussion that we've had  
20 about porosity, which has not been that much, but  
21 porosity in the documents that we've looked at has  
22 referred to, really, the open space between  
23 fibers, it's -- it's the background.

24 And I would -- I would say that there is  
25 a lower porosity in closely packed aligned fibers

1 compared to not closely packed aligned fibers, and  
2 I don't know, without doing a test side-by-side,  
3 how that porosity would be -- be functionally  
4 related to doing a random scaffold, because a  
5 random scaffold might have more porosity but less  
6 access to cells to get into.

7 So I -- I -- on the whole, I'm -- I -- I  
8 can -- I can agree with it, in a very generic way.

9 MS. WIEKER: Okay. I'd like to mark the  
10 challenge to '223 Patent as Exhibit 13.

11 (Simpson Deposition Exhibit 13 marked  
12 for identification.)

13 BY MS. WIEKER:

14 Q. Do you recognize that document?

15 A. I do.

16 Q. Okay. Do you see one of the inventors  
17 listed as Michael Francis?

18 A. I do.

19 Q. Do you know Michael Francis?

20 A. I knew him when he was a graduate  
21 student.

22 Q. Okay. Where was he a graduate student?

23 A. He was a graduate student in Gary  
24 Bowlin's lab.

25 Q. Did you work with Michael Francis?

1 A. I did not.

2 Q. What do you know about him?

3 A. Ph.D. --

4 MR. LEVINE: Objection to the form of  
5 the question.

6 THE WITNESS: He's a Ph.D. student in  
7 Gary's lab.

8 BY MS. WIEKER:

9 Q. Okay. Did you advise him or mentor him?

10 A. I did not.

11 Q. Okay. Are you familiar with the work  
12 Mr. Francis did while he was at VCU?

13 A. Certainly at one time I would have been.  
14 I -- I don't -- I -- I can't tell you what it is  
15 now, but at some point I would have known.

16 Q. Okay.

17 A. I would have known about all the -- I  
18 would have known what all the students were doing  
19 at the time. There were about eight or ten of  
20 them or so.

21 Q. Are you aware that Dr. Francis went to  
22 work for LifeNet, the patent owner in these  
23 proceedings?

24 A. Yes. There was something enter -- in  
25 between graduate school and that, though.

1 Q. Okay. Have you spoken with Dr. Francis  
2 since he left the VCU lab?

3 A. I have not.

4 Q. Do you understand that Dr. Francis later  
5 founded Embody, the petitioner in this matter?

6 MR. LEVINE: Objection to the form of  
7 the question. Mischaracterize --  
8 mischaracterization. Objection to  
9 foundation.

10 BY MS. WIEKER:

11 Q. Are you familiar with someone named Yas  
12 Maghdouri-White?

13 A. Do you -- do you have that written down  
14 somewhere?

15 Q. Sure. Yeah.

16 A. I might recognize it --

17 Q. That's fine.

18 A. -- if it's written down.

19 Q. We can go this way.

20 MS. WIEKER: We'll mark this as  
21 Exhibit 14.

22 (Simpson Deposition Exhibit 14 marked  
23 for identification.)

24 THE WITNESS: Thank you.

25 Boy, that's a generous comment, that I

1 was a mentor to him. I had conversations  
2 with him. I don't think that makes me a  
3 mentor.

4 I think he is attempting to build his  
5 reputation through mine. I was on his thesis  
6 committee; I read his thesis at one point.

7 MR. LEVINE: I don't -- I don't think  
8 there's a question pending. Is there a  
9 question pending?

10 THE WITNESS: Do I know this woman?

11 MS. WIEKER: I asked if Dr. Simpson  
12 knows Yas Maghdouri-White.

13 MR. LEVINE: Okay.

14 BY MS. WIEKER:

15 Q. And Dr. Simpson indicated that he may.  
16 And so now we're taking a minute to look at  
17 Exhibit 14.

18 So, Dr. Simpson, are you familiar with  
19 Yas Maghdouri-White?

20 A. She does not ring a bell.

21 Q. Did you indicate you were on her thesis  
22 committee?

23 A. I was on Michael's thesis committee.  
24 And I might have been on hers. I -- I -- I don't  
25 remember.

1 Q. Okay.

2 A. I just don't know.

3 Q. Did you mentor Ms. White?

4 A. No.

5 Q. So the statement --

6 A. She's not in my lab.

7 Q. The --

8 A. She's not in my lab.

9 Q. The statement on page 3 of 8 in  
10 Exhibit 14, it says: Maghdouri-White recalls  
11 mentorship from faculty members, including David  
12 Simpson.

13 That statement's incorrect?

14 A. Oh, well, since I don't remember her, I  
15 can't say one way or the other. I don't remember  
16 her. She was not in my laboratory.

17 Q. Okay.

18 A. She was likely in Gary's laboratory,  
19 who -- whose lab was 4 miles away from mine.

20 Q. Okay. Would you have been in touch with  
21 her since she left VCU?

22 A. No.

23 Q. Okay. Are you aware that she works for  
24 the petitioner, Embody, and Zimmer Biomet?

25 A. Nope.

1 Q. Okay. Okay. Prior to when you were  
2 retained for these matters, had you heard of  
3 Embody, Inc.?

4 A. Had I heard of them?

5 Q. Yes.

6 A. I -- I don't think I did. I don't think  
7 I had.

8 Q. Prior to when you were retained by  
9 petitioner for this matter, had you heard of  
10 Zimmer Biomet?

11 A. Zimmer, I would have seen, you know,  
12 searching various electrospinning, various fiber  
13 constructs, I would have run across Zimmer. It --  
14 it was from -- the name was familiar to me when I  
15 was contacted.

16 Q. Okay. Are you familiar with a product  
17 called Tapestry?

18 A. I think I am. I -- is -- help me out  
19 here. Is that a Zimmer product?

20 Q. It's a Zimmer product called the  
21 Tapestry Biointegrative Implant.

22 A. And is this -- I'm recalling this is for  
23 rotator cuff, that's the one I'm familiar with.

24 Q. Okay. Have you ever created a 2D FFT  
25 alignment plot of the Tapestry product?

1 A. I have not.

2 Q. Okay. Are you familiar with a product  
3 called ActivBraid?

4 A. Is that also a Zimmer product?

5 Q. It is.

6 A. Yes, I -- I -- I can picture that, also.

7 Q. Okay. Have you ever performed a 2D FFT  
8 alignment plot of the ActivBraid product?

9 A. I -- I certainly didn't provide one to  
10 the attorneys. I don't recall. I mean, I -- I --  
11 you know, I was -- I would have found these  
12 materials before this project started, and would  
13 have looked and said, "Oh, they got something on  
14 the market that I wish I had on the market," and  
15 that would be about it.

16 Q. Okay. One last question about the '223  
17 Patent. If we could turn back there, please. It  
18 was Exhibit 13.

19 Can you show me where -- actually, start  
20 over.

21 Does the '223 patent disclose use of a  
22 mask?

23 A. Okay. Okay. Okay. I -- I understand.  
24 I have to look at the references to see what  
25 papers he submitted --

1 Q. Uh-huh.

2 A. -- or what papers he cited. It's a very  
3 short list, an inadequate list of papers.

4 He cites the 2008 paper.

5 Q. Uh-huh.

6 A. He cites the 2008 paper, which is the  
7 book chapter.

8 Q. Exhibit 4.

9 A. Knew I'd get into trouble here. I keep  
10 doing that. I'm sorry. There we go. Wait. It  
11 was the 2008 paper --

12 Q. Correct.

13 A. -- he cited, not the 2006. I have the  
14 wrong paper here.

15 Q. Should be Exhibit 4.

16 A. There we go.

17 Q. To refresh your recollection, we talked  
18 earlier on page 615 --

19 A. Thank you.

20 Q. -- about the statement: Although this  
21 type of mask can be useful in many applications,  
22 it reduces the total surface area available for  
23 analysis.

24 A. Oh, okay. So it does refer to this --  
25 it does refer to this paper, which refers to using

1 a mask, yes.

2 Q. Right. And does this 2008 paper, what's  
3 marked Exhibit 4, require the use of a mask?

4 A. No.

5 MS. WIEKER: Okay. Okay. With that, I  
6 have no further questions for you,  
7 Dr. Simpson. Thank you for answering my  
8 questions. And I appreciate your testimony.

9 THE WITNESS: Thank you for making me  
10 miserable.

11 MR. LEVINE: I have -- I just have a  
12 couple of questions.

13 MS. WIEKER: Of course.

14 MR. LEVINE: Sure.

15 - - -

16 EXAMINATION

17 BY MR. LEVINE:

18 Q. So Exhibit 4, which we were just looking  
19 at --

20 A. 2006, yes.

21 Q. -- that's the 2000 --

22 A. 2008, I'm sorry.

23 Q. I think counsel asked you if it requires  
24 the use of a mask.

25 A. I -- she did. And I thought I answered

1 that no, it doesn't need.

2 Q. Does it --

3 A. I -- I --

4 Q. Does --

5 A. I thought I said no.

6 Q. Okay. Does it teach the use of a  
7 mask --

8 A. It does teach the use of a mask.

9 Q. And what is your opinion as to whether a  
10 skilled artisan looking at Ayres 2008 would  
11 understand the circumstances where a mask is and  
12 is not needed?

13 A. I would say that, for example, Chantal,  
14 who really was instrumental to writing these two  
15 papers, would be able to look at an image and  
16 discern whether a mask would be helpful or not in  
17 reducing whatever noise that she thought needed to  
18 be removed from a data set.

19 Q. Let me -- thank you. Thank you. Let me  
20 turn you back to Exhibit 1, which is your  
21 declaration for the '2 -- '223 Patent.

22 A. Wait. Okay. I got '223.

23 Q. There it is. And can you turn to  
24 paragraph 105.

25 A. Okay. I'm there.

1 Q. And could you review paragraph 105.

2 A. Pardon me.

3 Yes.

4 Q. And is paragraph 105 discussing the  
5 figures immediately preceding paragraph 105?

6 A. It is, those are the two figures from  
7 the Huang paper.

8 Q. And do you recall discussing with  
9 LifeNet's counsel the shape of the curve in  
10 Figure C?

11 A. I do.

12 Q. Does Huang himself characterize the  
13 shape of the curve in Figure -- in Figure C that  
14 has the red arrow?

15 A. He -- in the -- in the following  
16 paragraph, which is a quote from the paper, he  
17 says there's a tall narrow peak.

18 Q. And is that consistent with your  
19 analysis, Dr. Simpson?

20 A. It is. And again, I can't emphasize  
21 enough that "sharp tall" is relative.

22 Q. And --

23 A. It's not absolute.

24 Q. And sitting here today, you have no  
25 reason to disagree with Huang about --

1 A. No.

2 Q. Okay.

3 A. He did anisotropic -- he calibrated  
4 this -- he actually went the extra mile and  
5 calibrated and proved that there was alignment in  
6 the scaffold by demonstrating that there were  
7 anisotropic mechanical properties. That's the  
8 gold standard for knowing if something has mostly  
9 aligned elements, because you're testing the  
10 entire scaffold at once.

11 MR. LEVINE: Thank you. I have no  
12 further questions.

13 MS. WIEKER: Thanks.

14 MR. LEVINE: Thank you.

15 MS. WIEKER: Okay.

16 MR. LEVINE: We're done.

17 THE VIDEOGRAPHER: This concludes --  
18 this concludes for today's deposition. The  
19 date is October 7th, 2025, the time is  
20 3:24 p.m., we are now off the record.

21 (Deposition concluded at 3:24 p.m.)

22 (Signature rights waived.)

23

24

25

COMMONWEALTH OF VIRGINIA AT LARGE, to wit:

I, Kimberly L. Ribaric, Registered Professional Reporter, Certified Court Reporter and Electronic Notary Public in and for the Commonwealth of Virginia at Large, and whose commission expires August 31, 2028, do certify that the aforementioned appeared audio-visually before me, was sworn by me, was thereupon examined by counsel, that review was waived; and that the foregoing is a true, correct, and full transcript of the testimony adduced.

I further certify that I am neither related to nor associated with any counsel or party to this proceeding, nor otherwise interested in the event thereof.

Given under my hand and notarial seal at Fluvanna County, Virginia, this 15th day of October 2025.



Kimberly L. Ribaric, RPR, CCR

Electronic Notary Public Registration No. 348266

My commission expires: 8/31/2028

Commonwealth of Virginia at Large