MR. LANE: That's all. Thank you.

THE COURT: Members of the jury, do you want to take a recess about now? Anybody in -- I'm seeing a little distress. We'll take a brief recess. Be back before 11:00 o'clock.

(Recess.)

(Jury present.)

THE COURT: All right, defense may inquire, please.

CROSS-EXAMINATION

MS. WOOD: Thank you.

Q. I kind of want to start at the beginning and go through so that I have a better understanding from you what DNA is, these type of testing processes that you talk about, how you look at results, and particularly with mixed stains, those kind of things. So would you start with me at the beginning?

I think the first thing you mentioned to us was that you find DNA in nucleated cells?

A. That is correct.

Q. Okay. I'm going to put -- just draw some while I'm talking to you, because it's easier for me if I see things. Cells are kind of irregular-shaped objects that you see under a microscope?

A. Right.

Q. And am I correct that the diameter of the cell is

about one-tenth the diameter of a human hair?

A. That would depend greatly on the type of cell, whether you're talking about a blood cell or a skin cell.

Q. But they're really tiny?

A. They're very tiny. You have to see them with a microscope.

Q. Does nucleated mean that there's some kind of center in a cell?

A. Basically, yes.

Q. Nucleus. And is this nucleus of the cell where the DNA comes from?

A. Yes, it is.

Q. All right. Because I think you told us that, for example, in blood there's red blood cells -- I'm just going to put an R -- and there's white blood cells, right?

A. Right.

Q. And you told us that you can only get DNA from the white blood cells?

A. That is correct.

Q. Because that's the only one that has a nucleus in it?

A. Right.

Q. The red blood cell doesn't have one of these dark centers?

A. Right.

Q. Okay. What is in the nucleus that DNA comes from?
A. Well, the basic backbone of DNA is there are four, basically, molecular molecules. We refer to them as A, G, T, and C.
Q. You've got a board back there, and so if it's easier for you to write -- let me back you up, though.
Does DNA come from chromosomes? Is it inside chromosomes?
A. Yes. It's like I said, it's wound in the chromosomes.
Q. Okay. So the nucleus has chromosomes?
A. Right.
Q. And we get chromosomes from our mother and our father, right? We inherit pairs of those?
A. Right. You actually have 22 sets, and then an extra one being the sexing, whether it's an X or a Y. So, a total of 23.
Q. And chromosomes are made up of genes?
A. Okay.
Q. Is that --
A. The genes are found on the chromosome.
Q. And is it genes that determine, for example, the color of my eyes?
A. Yes.
Q. The color of my hair, those kind of things? How

tall I am, those kind of things?

A. Yes.

Q. Okay. And is DNA part of genes?

A. Yes.

Q. Okay. Is DNA what essentially -- the molecular compound that makes up genes?

A. Right, the DNA is the genetic building blocks. They are nucleotide sequences which code for the gene, which the genes code for your hair color, your eye color.

Q. Okay. And you started talking about these building blocks of DNA, what DNA is made up of, and you were talking about A, G, T, C.

A. Right.

Q. Can you tell the jury -- if it helps, just draw those blocks on that bulletin board behind you so they can see. Think there's a pad on the other side. You can mark on that, I guess.

A. Basically, there are four building blocks to DNA. That's all it takes to make all the different codings, all the different proteins to make us what we are. You know that G and C are always going to bind together, and A and T are always going to bind together. And it is this that forms -- when you think of DNA, and you often see it in literature, and there's been a lot in the newspaper, this double helical structure -- I'm not very good at drawing this, but it kind of

understand. This CSF1PO, that's a particular -- can we say gene just for simplicity?

A. Sure, that's the gene. That's the place on the chromosome.

Q. And just hypothetically let's say this is the eye color gene.

A. Okay.

Q. Okay. And these numbers represent alleles, is what you're telling us?

A. Correct.

Q. And alleles, basically, means the variations --

A. Right.

Q. -- of this gene. For example, some people have a gene for brown eyes. That would be one type of allele. I'm simplifying this with you.

A. That's the idea.

Q. Other people have -- their eye color gene is blue. That would be a different allele?

A. Correct.

Q. Okay. Other people's eye color is green. That would be yet a third type of allele?

A. That is correct.

Q. So add a particular gene, the eye color gene, there might be five different alleles, just for example, right?

A. Correct.

Q. Different eye colors. And these numbers is just the way that scientists name that particular allele. For example --

A. That is right.

Q. -- 13,7 might be the allele for brown eye color.

A. Right. They have to record it somehow. Document it.

Q. All right. It's just using numbers instead of a name, sort of?

A. Right.

Q. Thirteen, 12 might be the name for the allele for green eyes?

A. You could interchange the letters for the numbers.

Q. And those alleles are defined by the number of base pairs?

A. Right.

Q. Okay. And again, let's just use this same hypothetical. Blue eyes might be an allele with four base pairs.

A. Okay.

Q. Like what we're showing. Green eyes would be an allele with 15 base pairs.

A. Right.

Q. Okay. Just for hypothetically. Then when you test, you're testing, basically, measures, how many base

pairs, how long these alleles are, right?

A. Right. In the STR's, we're not really measuring how long they are, we're measuring how many of the repeated sequence there are. In that case, if that's one repeat sequence of four base pairs, then it's the amount of how many times do you see that four base pair sequence.

Q. Actually, it's length that we're dealing with when we get to the RFLP?

A. Right.

Q. Restriction length fragment --

A. Restriction fragment length polymorphism. And that has to do with -- again, it's all based on how many base pairs there are, because that gives to the length and the weight of the molecule.

Q. Most of the testing that the jury's going to hear about in this case is PCR testing, right?

A. Right. Most of it was done by the six markers I do, or the STR's that GeneLex did.

Q. You've just talked to us about repeat units of base pairs. Can you use your diagram up there, maybe, and just let the jury understand pictorially what you mean by repeat units?

A. We'll make a real short repeat, which is actually what the STR's are, the short tandem repeats. Let's just go with -- I'll put a little line so it's easy to see.

We all know that the other side would look like

this. But, basically, that would be one repeat unit. And then it comes down here again, the same thing, like this. And we repeat it down here like this. Now we have one, two, three. So it's repeated three times, that pattern. And that's what is reflected on the STR readings.

Q. All right. In the different numbers?

A. Right.

Q. Okay. So let's say you've got three repeat units. That could be for the variation of the eye color gene, the allele that is blue eyes.

A. Right. If you have three of these, you have blue. Let's say if you have five of them, maybe it's green. And in this case, the function of that gene is all the same. It doesn't matter whether we have blue eyes or green eyes. They all do the same thing for us. But this is what forensics looks at.

Q. And the STR testing actually counts how many of those base pair or repeat units there are?

A. Right, how many of the repeat units there are.

Q. All right. Have a seat. Thanks.

You talked to us, also, about differential defraction.

A. Differential, right.

Q. And that is when you try to separate out the sperm cells, actual spermatozoa from the other nucleated cells?

A. That is correct.

Q. I wanted to ask you, are sperm cells nucleated cells?

A. Well, they, in and of themselves, are considered -- yes, the nuclear material is within the sperm head, primarily in the acrosome, which is the top of the sperm head.

Q. I'm going to draw it with a little tail or something. I'm going to -- sperm. There's nucleated material in there with DNA, right?

And in the epi cells that are nucleated, there's DNA. If this is an epi cell from Jon, and this is a sperm cell from Jon, is this DNA going to be the same?

A. Yes.

Q. So it doesn't give you a different DNA profile. It's got the same DNA code in every cell of our bodies that have nucleus, that are nucleated, right?

A. That is correct.

Q. When you do this differential defraction, you try to separate out the sperm cells from the epi cells?

A. That is correct.

Q. And I think you told us you can do that because there's chemicals that you can pour onto the epi cells that will break them apart and you can extract the DNA. And those same chemicals, they can't break the sperm cells.

A. Right, under normal conditions, they won't. There

are times when the semen, maybe due to environmental, you know, assaults that have been placed on them, maybe because of being degraded, they actually will pop open, they'll break open easier. Under normal conditions, ideal conditions, they will not break open with that first chemical.

Q. And then you put another chemical on. You take this out. Then you put another chemical on, and it breaks or finishes breaking the sperm cells?

A. Right.

Q. And it's true, though, that this differential process to differentiate the sperm from the epi cells isn't always perfect.

A. Right, it is not always perfect.

Q. And sometimes you can get DNA -- let's say you got two individuals, okay? A female, happen to have a female's epi cells and, of course, you've got the male sperm cells. Sometimes when you do this differential defraction, you can get the male's -- DNA from the male showing up in your female, your epi fraction, right?

A. Yes, you do.

Q. And vice versa as well. Sometimes you can get DNA from the epi cells of a female showing up in the sperm fraction of DNA?

A. That is correct.

Q. And GeneLex, they use, for the sperm fraction, they

used E2?

A. They call it E2 fraction, yes.

Q. They call the epi fraction E1?

A. Yes, they do.

Q. And you've told us that these epi, epithelial cells can be male and female, right?

A. Right. I mean, because the only different things in regards to the gender has to do with the sperm. Other than that, any DNA from a man would be in the epithelial fraction.

Q. So I'm going to try to consistently talk about epi cells or epithelial cells instead of female, because I think that maybe confuses stuff, since it applies to all male cells other than spermatozoa?

A. Sure.

Q. The PCR process that you do, you talked about that you would take, usually, a cutting of material, and then extract fluids or whatever is on that, the cells from that, break that open, and get the DNA, right?

A. Right.

Q. And then you do a process that takes those two rungs of the ladder and strips them in half, pulls them apart?

A. Basically, that's exactly what we do when we put it in the thermocycler that I mentioned. It's kind of like my Xerox machine. The way it actually amplifies copies is by a heating and cooling system. When you heat the DNA up, you can

break apart that ladder. You have two strands now. And we know that with proper chemicals in place, that ladder, those two strands, they're going to replicate each other, just like your body does when it's building new DNA from new cells.

And by adjusting the temperature, it does -- cool it down, it replicates itself. You heat it back up, it breaks apart. You cool it down, it replicates itself. And it does this in, basically, an exponential fashion. So if you have two copies, it goes 2, 4, 8, 16. So you can start with a very small amount of DNA. And it takes me about two and a half hours for this to go through this machine. I can basically have a billion-fold copies of the amount of DNA of that particular gene or marker that I was looking at, enough to type.

Q. And you've used -- we used the words type, match, profile, talked just a little bit about those.

What do you mean when you use the term DNA profile?

A. Basically, I'm calling it like a genetic profile. We had a chart here. Mr. Lane had a chart showing five individuals involved here. And using the GeneLex STR results, he had across there what I would call their genetic profile. What they are, at each marker or each locus they're typed, and then the combination of all eight of them there, that would be their genetic profile.

Q. All right. And so what you're doing, basically, is

you're looking at what -- we'll use GeneLex. They use eight markers, eight gene locations. So they pick eight locations, eight genes, particular genes, and those genes all have a number of different variations?

A. Right.

Q. Could be eye color, hair color, and, again, I'm just using hypotheticals. And so then they determine what any given individual's allele is at that point. For example, I have -- used to have -- black hair, brown eyes, those kind of things. So that would make me different from, at those particular genes, at those particular loci, from other people, right?

A. Right.

Q. So scientists have pretty much -- they have gotten away from using the term DNA fingerprint?

A. Right.

Q. That would be a little misleading?

A. That came about, basically, when the RFLP method was first introduced, the fingerprint came. Everybody could make their own judgment, because it was so discriminating. When I tell you that that RFLP profile occurs in one in less than ten billion, and that is our crime lab's cutoff, the number actually may be greater than that.

The fingerprint came because it was sort of synonymous with ID. The scientists can argue whether that's

an ID or not. Everybody can make their own judgment whether that's actually a fingerprint. Because fingerprints, historically in forensics, had always had a lot of weight to them as far as being able to put that fingerprint to that person. So that's kind of where that name came from.

Q. In this case, the standards in this case being the genetic profile, the DNA profile from Miss Bendele, Brandon Williams, Conan Hale, Jon Susbauer, Patrick Finley, all of these individuals have a different profile, DNA profile, right?

A. That's right. If you look across there, their profile, meaning all eight markers together, they're different. Nobody has the same profile. There may be certain markers, or maybe one or two of them, or three of them have the same alleles, because there are only a certain amount of alleles at each one of these markers. But take the whole profile away and you look at it all together, nobody is the same.

Q. And you were saying sometimes you can have the same alleles at a particular gene but you won't have the same alleles at every gene all the way across, right?

A. And that is where that population frequency comes into it. How likely would you expect somebody else to have that same genetic profile?

Q. And do you have a small version of that chart in