VOLUME IX

C A N A D A

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK

TRIAL DIVISION

JUDICIAL DISTRICT OF FREDERICTON

B E T W E E N:

HER MAJESTY THE QUEEN

- and -

ALLAN JOSEPH LEGERE

VOIR DIRE PROCEEDINGS Held before Mr. Justice David M. Dickson at the Burton Courthouse, Burton, New Brunswick, on the 9th day of May, A.D., 1991.

APPEARANCES:

Graham Sleeth, Esq.,)
Anthony Allman, Esq.,) for the Crown.
John Walsh, Esq.,)

Weldon J. Furlotte, Esq.,)
Michael Ryan, Esq.,) for the Defence.

Nancy M. Patterson
Court Reporter

I N D E X

Attached pages 78 to 82 apparently were missing from Volume VI of the R vs Legere transcript of the evidence heard on May 3, 1991. (Cross examination of Dr. John Waye). Please check your copy and insert these pages if they are not present in your copy.

COURT: Well, let's give Mr. Walsh an opportunity to state his position.

MR. WALSH: My Lord, one of the earliest -- as you are probably aware, one of the earliest decisions in Canada with respect to the use of textbooks and authorities on expert witnesses is a case known as the Queen versus Anderson, and it's reported (1914) 16 D. L. R. at 203, a decision of the Alberta Court of Appeal. In that particular decision at page 206 and 207, the justices were dealing with how examinations and cross-examinations of experts with the use of texts were to be dealt with, and they make the point that:

> "On cross-examination the Judge should be careful to see that an improper use is not made of text-books, practically to give in evidence opinions of absent authors at variance with those of the witness. It is quite apparent that if the witness is asked about a text-book and he expresses ignorance of it, or denies its authority, no further use of it can be made by reading extracts from it, for that would be in effect making it evidence..."

But if the witness, and I'm paraphrasing,

> "...admits its authority, he then in a sense confirms it by his own testimony, and then may be quite properly asked for explanation of any apparent differences between its opinion and that stated by him."

My understanding is, and again, considering the nature of this hearing, my understanding is that strictly speaking, and I don't know whether Dr. Waye is going to accept the authority of that or not accept the authority of it, but strictly speaking, a witness can't be asked to comment on something that either if he's ignorant of it in the sense that he hasn't made himself aware of it, or does not accept the authority of it. But we recognize

some -- the Crown recognizes that some leeway must be given to Mr. Furlotte in as much as if the Court was to decide that this was a Frye hearing, then the Court is entitled to look at other relevant scientific literature in the field.

COURT: Yes, well as the Anderson case, isn't it, points out, the mere incorporation of a statement from another article in a question and saying do you agree or not, doesn't make that proposition included in the statement evidence. I quite agree with the Anderson case.

MR. WALSH: I felt it necessary to make the statement now because of Mr. Furlotte's just recent comment that was almost to the effect of that he's putting -- he's making statements that there are people out there who disagree with Dr. Waye to that effect. I don't want any misconceptions about that.

COURT: Well, that is what Mr. Furlotte says and that isn't evidence, of course. But I would give Mr. Furlotte a fair freedom to put propositions up to a witness and say, "Do you agree with this," even though it may be incorporated in some article that the witness isn't aware of. I think that goes a little beyond the Anderson decision, but --

MR. WALSH: Yes, and we recognize that some leeway is required because if the Court were to consider this to be a Frye type hearing, yes, noting that there is other literature is an important thing. Whether it's authority, or accepted as authority, is something for the Court to make a decision of later. I just wanted to clarify that from the Crown's point of view at this point.

COURT: I want to make myself clear on one thing, and that is a lot of these articles that have been marked as exhibits here on the voir dire and the fact that they're accepted as exhibits doesn't mean that everything in those articles is proven or is evidence before the Court. A lot of these articles have been accepted through this witness, in particular, merely to show that he was familiar enough with the subject -- this is as I take it, in any event -- merely to show that he was familiar enough with the subject that he could prepare a scientific paper which was peer approved and published in an article or something. But you can be sure that for the purpose of this voir dire, I'm not going to read through every one of those articles and say how does this statement balance with that statement. There must be all sorts of divergent statements.

MR. FURLOTTE: No, My Lord, and the only purpose that I would want something like this into evidence is not to try and disprove that Dr. Waye's opinion -- or to prove that his opinion is wrong, definitely. The only reason is to show that there is controversy out there about his opinion and about the subject matter that the Court has to rule on.

COURT: Well, when you say that, though, you're asking the Court to accept that these other views have some authenticity and I'm not sure that that's really warranted. You're asking him for his opinion. Now, you may get the witness to admit that, yes, that is a view of a certain portion of the scientific community or you may, through your own witness, establish that a view of a portion of the scientific

community is so and so as contained in that article. But the mere fact you incorporate it in a question doesn't --

MR. FURLOTTE: In all fairness, Dr. Waye's opinion might very well be right. As I understand, and I've been reading through the materials, that other people have different opinions and I would like his expertise to be able to explain why these people may be wrong and he's right.

COURT: Well, one of your purposes on cross-examination, presumably, would be to endeavour to get the witness to acknowledge that there is a certain divergence of opinion on a certain field and perhaps he's prepared to do that, perhaps he isn't, depending on the area you're talking about.

MR. FURLOTTE: My Lord, as I think I explained myself when we started this voir dire that the only thing I am after is trying to search out what the truth is about the reliability of DNA testing and this is the only way I know how to do it.

COURT: We are sort of going a little beyond the conventional wisdom in cross-examining expert witnesses. The traditional advocacy policy as I've known it has always been that in cross-examining an expert, you keep it as short and as confined as you can in your cross-examination. You examine on areas where you know he is the weakest and you try to make your point to show that there's a weakness in his theory or his opinions or you try to cross him up in those few fields where you can be sure you're going to get the right answer. If you keep plugging away at things where there isn't any weakness shown, it sometimes only serves to strengthen the evidence

that the witness has given and perhaps to confirm that he is a true expert.

MR. FURLOTTE: And that's the gamble I must take, My Lord.

COURT: I am not trying to tell you how to run your cross-examination, but I think normally one would -- I think that traditional wisdom or conventional wisdom and advocacy is probably to put more reliance in establishing your case through your own witness or witnesses than it is to try to break down some other expert. I suppose the reason is that lawyers take on something more than a match when they take on experts. This applies to counsel on the other side as much as to --

MR. FURLOTTE: Oh, I concede that fact, My Lord.

COURT: Well, having said that, I won't say anything more.

Q. Dr. Waye, in the opening paragraph of that article it states, "One criticism of DNA fingerprinting is that the VNTR loci used for the fingerprints violate the assumption of Hardy-Weinberg equilibrium (H-W), making it difficult to calculate the probability of observing a genotype in the population." That would be starting at the third line down.

A. Yes, you read that correctly.

Q. And what is your position on that, that there are criticisms out there and whether or not they are valid?

A. There are criticisms. This article deals whether they are valid or not. If you go through this article and get to the meat of the paper and how they actually analyzed data and draw their conclusions, it's a very statistical paper dealing with formulas too long to state and involving Greek letters that I can' pronounce. I'm not a

(COURT RECONVENED ON THURSDAY, MAY 9, 1991 AT 9:30 a.m.)

DR. JOHN BOWEN, previously sworn.

DIRECT EXAMINATION BY MR. WALSH continued:

Q. Dr. Bowen, yesterday when we left you were about to refer to the autorads in the first gel, first membrane, that is set out in VD-55, the first section; is that correct?

A. That is correct.

Q. You will be using the slide projector?

A. Yes, I will.

Q. Do you prefer to stand up or sit down when you do this, Doctor?

A. I think for this part it would be easier to stand.

MR. WALSH: With the court's permission, My Lord?

THE COURT: Umm. The voice will pick up on the tape recorder.

Q. Tell us please what we have up on the slide projection screen at this time.

A. This first slide is the result of the first probing of a membrane designated "Gel #1" in VD-55. It is the membrane containing all the lanes I described yesterday. Do you want me to go through the list?

Q. Perhaps. Just briefly.

A. On top of the membrane,the autorads, you can see the designated exhibit numbers for each of the lanes thereby identifying where the DNA in each of those lanes was derived from. The first lane as I mentioned yesterday was a marker. The next lane, lane #2, is the known blood sample reportedly from Murphy. Lane #3 is the known scalp and pubic hair sample reportedly from Legere. Lane #4 is from

exhibit 115B. It is a known blood standard reportedly from Donna Daughney. Lane #5 is the DNA derived from the known blood sample reportedly from Linda Daughney. Lane #6, designated #1(i)F, is the DNA extracted from a vaginal swab reportedly from Nina Flam. This is the female fraction. Lane #7 is the male fraction of that same swab designated 1(i). Lane #8 is the female fraction of the swab exhibit 1(j) reportedly from Nina Flam. Lane #9 is a DNA marker. Lane #10 is the male fraction of exhibit 1(j), a vaginal swab reportedly from Nina Flam. Lane #11 is DNA extracted from exhibit 109, the female fraction of the vaginal swab reportedly from Donna Daughney. Lane #12 is the male fraction of that same swab, exhibit 109. Lane #13 is the female fraction of a body swab reportedly from Donna Daughney, exhibit 110. Lane #14 is the male fraction of that particular swab reportedly from Donna Daughney. Lane #15 is the female fraction of the vaginal swab, exhibit 134, reportedly from Linda Daughney. Lane #16 again is a DNA marker. Lane #17 is the male fraction of the vaginal swab reportedly from Linda Daughney, exhibit 134. Lane #18 is the female fraction of a body swab reportedly from Linda Daughney, exhibit 135F. This is the female fraction. Lane #19 is the male fraction of that particular swab, exhibit 135. Lane #20 is the female allelic control designated NM. Lane #21 is the male cell line ofthe allelic control. And lane #22 is another marker.

Q. Okay, Doctor. You have put the original of that particular autorad on the light box. Am I correct?

A. Yes. That is the original on the light box. This is a slide of that original.

Q. And if you are actually doing this in the laboratory which would you use to actually make your calls on?

A. I would always use the original to make an interpretation.

Q. The light box that you have here, is it the same kind of a light box that you have in your lab?

A. It is of a similar type, yes.

Q. Would you go ahead please and tell the court what, if any, calls you made with respect to this particular autorad?

A. With respect to this particular autorad -- first of all, I might describe what a match is, a visual match. A visual match at this stage is simply pattern recognition. It is the use of -- seeing the various bands in all the lanes and recognizing patterns within those loci that have been described by Dr. Waye and Dr. Carmody. This particular loci is D2S44 and for each of these lanes you can see in some of them bands. These bands form a pattern. One simply uses / the molecular weight markers run throughout the gel to recognize similar patterns and to see if they are the same size in the various lanes across the gel. For example, in lane 115B which is the known blood sample reportedly from Donna Daughney, one can see that there is a pattern similar to that in lane 109F. This is a vaginal swab reportedly from -- did I get that right? Did I say that 115B is the

known blood sample reportedly from Donna Daughney? 109 is the vaginal swab reportedly from Donna Daughney. It is the female fraction. Now, this is not unexpected that one has the same pattern in both these lanes because the epithelial fraction from that vaginal swab would contain DNA from that particular individual, Donna Daughney. Now, unlike one of the analogies given the other day in Dr. John Waye's testimony one is not comparing the size of these bands in lanes across the gel without some form of marker system or measurement. The analogy given was that we had two individuals of the same size. If they were at opposite ends of the courtroom, of course, it is very difficult to tell if they are the same height. The correct analogy is we have two individuals the same size standing at opposite ends of the courtroom. Each one of them is standing beside a tape measure. The analyst can go and see the markings on the tape measure beside one individual and can look at the tape measure beside the other individual and decide that, yes, of course, they are the same size.

That is the purpose of the visual markers during this interpretation. It is also used by the computer to derive a size for each of the fragments.

Q. Size being the computer quantification in base pairs.

A. In base pairs. It is the size of the fragment in base pairs.

Q. And the markers you are referring to are the lanes that have the heading "M"?

A. "M", yes. Now, for the forensic matches in this

particular hybridization with locus D2S44 I found a match between lane #3, which is the DNA from exhibit 56A-69A, matching the pattern found in lane 135, which is the DNA extracted from a body swab reportedly from Linda Daughney. That is the male fraction. The bands are faint. The faintness of the bands really only has to do with the amount of DNA loaded in those particular sample lanes. By comparison there is very little DNA within this sample lane where there is a substantially greater amount of DNA in the adjacent lane. Therefore the intensity of those bands is much greater than the intensity of those particular bands. It has nothing to do with the size of the band. It is just the intensity of the band due to the amount of DNA loaded in that particular sample.

Q. Now, which would be easier to see? On this particular slide or on the original on the light box?

A. Be easier to see these bands here and here on the original autorad. One would have to stand a little closer to it. Sorry, My Lord. This is the first probing for locus -- that was done on this particular membrane. Locus D2S44, as in chart VD-27. It is on chromosome two.

Q. What, if anything, did that mean to you at this stage? The fact that 56A-69A and the male fraction, 135, matched?

A. It means that the DNA patterns and DNA profiles obtained from those two DNA samples are consistent with having come from the same individual.

This next slide is a second exposure of this particular probing. It is -- the membrane was put back on film and I believe this is for 98 hours. The first exposure was 23 hours. You will notice there is a fair amount of background which is really enhanced on the slide as compared to the original in certain areas. This certainly comes out a lot darker. You will notice the contrast on the slide is quite different from what one sees in the original. However, what one can see is again -- there is still that match --it is somewhat obscured by the slide -- between the bands found in 56A-69A to the bands found in lane 135, the male fraction of the body swab reportedly from Linda Daughney. Now, because of this background, I wanted to clean this up or make this a better original autorad for presentation purposes. I have reprobed this particular membrane with the same probe after stripping off all this background. This background is non-specific binding of the DNA probe to the membrane.

Q. Why did you expose the first autorad you showed? Why did you expose it longer resulting in this particular autorad?

A. One always exposes an autorad to several different exposure times. This is in order to bring up faint bands so one can visualize them better or get the proper exposure so that one can read the markers and all the evidentiary sample at one time. We are dealing here with samples that are close to the limits of sensitivity which poses a slight problem in exposure times. One has to go to fairly lengthy

exposure times in order to see these particular patterns.

Q. What do you mean that we are dealing with samples that are close to the limits of sensitivity?

A. The amount of DNA isolated from these exhibits, particularly 56A-69A, and the vaginal swabs, body swabs, was very close to the limits of sensitivity of the technology. We are dealing with amounts of DNA, roughly 40 to 50 nanograms of DNA, which is a very small amount of DNA.

This next slide is actually a reprobing of that membrane with the same probe, D2S44. This was stripped, hybridized with several other probes, before I went back to this particular locus. What it gies you is a lot less background.

Q. This would be the third autorad set out in VD-55 under the first section?

A. That is correct.

Q. Would you show us please what, if anything, you can note from that particular autorad?

A. In this particular autorad obviously there is a lot less non-specific binding of the probe. The background is a lot cleaner background and one can see easily the two bands in 56A-69A match the two bands -- visually match the two bands in lane 19 which is the DNA from the male fraction of the body swab reportedly from Linda Daughney.

MR. WALSH: My Lord, at this time with this laser pointer is anyone having difficulty actually seeing the point the Doctor is referring to or would the court prefer he used a normal pointer to show the bands?

THE COURT: No. Well, I can't speak for others in the courtroom, but I can see. Perhaps you would just indicate again --

A. The lane is 56A-69A, the two bands there. One there. The upper band there, the lower band there. Lane 135, the upper band there, the lower band there. (indicating)

Q. Continue, Doctor.

A. This next slide is the second locus I probed. D1S7. On VD-27 one can see it is on chromosome one. Perhaps you would want to summarize the results?

Q. Yes. We have a summary chart, My Lord. A chart headed 'Summary Chart Blot 89-0L11-91-6 and the Doctor intends to summarize his results as he goes through using this particular chart. With the court's permission I would ask he be able to refer to it and perhaps we will have it marked at the conclusion of his testimony if that is all right.

THE COURT: Yes. You are going to mark on that. Yes. As you go along. You have the data on there now and you are going to reveal it as you go along.

A. Yes.

Q. Perhaps I could get you to go to the other side, Doctor, so the Judge can see.

A. So far we have looked at locus D2S44. With respect to the forensic matches,I am referring to exhibit 1(i) which is the male fraction of the vaginal swab from Nina Flam, exhibit 1(j) which again is the mail fraction of the vaginal swab reportedly from Nina Flam, exhibit 109 which is the male

fraction of the vaginal swab reportedly from Donna Daughney, exhibit 110 which is the male fraction of the body swab reportedly from Donna Daughney, and exhibit 135 which is the male fraction of the body swab reportedly from Linda Daughney.

Q. And your conclusions with respect to D2S44 on this particular blot?

A. With respect to the particular blot we were showing before the results were inconclusive for exhibit 1(i), 1(j), 109, 110 and there was a match seen between exhibit 135 and exhibit 56A-69A, which is the hair standard reportedly from Legere.

Q. And when you say a match you are referring to at this point in time a visual match?

A. That is a visual match.

Q. I see. Would you tell the judge please why you arrived at the conclusion that the other exhibits, 1(i), 1(j), 109 and 110,were inconclusive?

A. If we go back to that slide --

Q. D2S44.

A. -- it was inconclusive in the sense that in exhibit 1(i) there were no bands present that matched those of 56A-69A. Again there were no bands in exhibit 1(j) which matched those of 56A-69A and the same follows through for exhibit 109 where there is a match between the bands found in exhibit 109 which match exhibit 115 which is the known blood sample reportedly from Donna Daughney. Since it is her swab that is no surprise. Exhibit 110,there were no bands that matched exhibit 56A-69A. The other conclusion to be made from this particular blot,

of course, is that one other individual here found in 157A is excluded as being a possible source of the DNA found in exhibit 135. Does not share the same pattern.

Q. Now, what, if any, conclusions can you draw from the fact that you saw no bands in the lanes you mentioned?

A. The fact that there is no bands in those particular lanes means that either the probe wasn't sensitive enough to pick it up -- senstive enough to visualize any DNA in that particular lane or perhaps there was not enough DNA to visualize with any probe system.

Q. Doctor, if you could clarify something please. I note in lane 109 and 109(f) -- first of all, perhaps I won't lead you. Tell me whether or not the bands in 109(f) and 109 visually match in your opinion.

A. Yes, they do.

Q. What does that mean to you? What does that tell you?

A. It tells me that the differential extraction -- remember I mentioned yesterday what we attempt to do with the differential extraction is to separate found DNA/from vaginal epithelial cells, female fractions from any male specific DNA in for example sperm. I mentioned yesterday this is not always a total separation of the two forms of DNA. In fact here we have evidence that there is vaginal DNA from vaginal epithelial cells in that particular vaginal swab from the donor of that swab which in this case is Donna Daughney, and that there is some carryover of the vaginal epithelial cells into what is normally

called the male fraction. In fact we stopped using that particular terminology because unfortunately it confuses individuals. One says female fraction and male fraction. One expects an absolute separation. That is not the case with all swabs. Often there is carryover of female DNA into the male fraction.

Q. What, if any, reservations do you have about the conclusions you have drawn with respect to the locus D2S44 on this blot?

A. I have no reservations about the calls made on this particular blot.

Q. Doctor, would you go to the next probe?

A. The next probe site, as I indicated previously, was D1S7. It is on chromosome one.

Q. That is -- just for the record again -- is set out in VD-55 in the first section. Continue, Doctor.

A. With this particular locus I found two forensically significant matches. The first forensically significant match is the match between the bands found in lane 3, which is exhibit 56A-69A, visually match the bands seen in lane 1(j), which is the male fraction of the vaginal swab reportedly from Nina Flam. The second match that was determined on this particular hybridization was the match between exhibit 56A-69A to the pattern found in exhibit 135, the body swab reportedly from Linda Daughney. That is the male fraction of that particular swab.

THE COURT: Those are lanes 3and --

A. 3, and 1(j) is lane 10 and lane 3 and lane 19.

Q. At this point in time, Doctor, you are referring to a visual match. Am I correct?

A. That again is a visual match.

Q. And at this point what, if any, conclusions can you draw from those calls -- those matches?

A. On those particular calls I cannot exclude the donor of exhibit 56A-69A as being a possible contributor of the DNA found in lane 1(j), the male fraction of the vaginal swab reportedly from Nina Flam and the DNA found in the body swab, exhibit 135, reportedly from Linda Daughney.

THE COURT: Would you put your marker just on the bands there?

A. That one and that one.

THE COURT: And in the other row?

A. They are very faint in lane 1(j). One has to look at the original autorad.

THE COURT: I see.

Q. That would be consistent with what?

A. That is consistent with having come from a common source. Exhibit 56A-69A as being a common source with 1(j) and 135.

Q. And what, if any reservations do you have, Doctor, with respect to those conclusions?

A. I do not have any reservations with respect to those conclusions.

Q. Would you refer to your summary chart please and take us through -- is this -- do you have another blot of this?

A. No, I don't.

Q. Okay.

A. So far we have now looked at two loci. The addition of D1S7 we have seen a match between exhibit 1(j) and

exhibit 56A-69A, and again we have seen a match between exhibit 135 and exhibit 56A-69A. So therefore at this stage we have two matches. The two loci for exhibit 135 and we have one match and one inconclusive result for exhibit 1(j) with 56A-69A.

Q. Doctor, please tell us, on this chart under D1S7 you have marked -- or at least what is taken to be inconclusive for 1(i), inconclusive for 109 and inconclusive for 110. Am I correct?

A. That is correct.

Q. Please tell the court why you arrived at those conclusions?

A. They are inconclusive for any match between exhibit 56A-69A because there are no bands present in those samples that have not already been accounted for that could have arisen from the same individual as having donated exhibit 56A-69A. 1(i) being this lane here. (indicating) The band can be attributed to the same donor as the female fraction in 1(i)F and exhibit 109, again the two bands present in exhibit 109 match that of the donor of exhibit 115(b), Donna Daughney, and 110, there are -- no band is visible on this particular slide that one can determine.

Q. Continue please, Doctor.

A. This next locus is D4S139. It is a fairly sensitive probe in the sense it is in our arsenal or panel of polymorphic probes. It is probably our most sensitive probe. It will pick up smaller amounts of DNA and give us a type of a result with that.

Q. Okay. So this locus is D4S139, you have the original on the light box for the record.

A. Yes, I do.

Q. And this is -- the duplicate original of this is set out in VD-55, the first section.

A. That's correct.

Q. Okay, Doctor, would you please tell us what conclusions you drew from this particular --

A. From this particular locus one can see several matches, forensically significant matches, between 56A and several of the samples loaded on this particular gel. The first one that I would point out is the match between the bands found in lane 56A-69A to the bands founds in lane 1(i), which is lane #7. This is the male fraction of a vaginal swab reportedly from Nina Flam. There are four bands in that lane. What one can see in the female fraction is two bands that have much higher intensity than the two bands that match them in lane 1(i). This would be expected if one has an incomplete separation of the female fraction found in exhibit 1(i), the vaginal swab reportedly from Nina Flam, and some carryover of that DNA into the male fraction. The lower two bands one can see match the bands found in exhibit 56A-69A. In the second vaginal swab reportedly from Nina Flam one can see with this very sensitive probe that there is no carryover of the female fraction into the male fraction by looking at lane 1(j)F, which is lane #8 comparing it to lane #10 which contains the DNA from the male fraction of that particular swab. Here is the female fraction. One cannot see any carryover of DNA from the female fraction. The pattern

found in lane 1(j) matches that of exhibit 56A-69A. The next match denoted on this particular probing was the match between lane 56A-69A to the DNA pattern or profile seen in lane 110 which is lane #14. It is the male fraction of the body swab reportedly from Donna Daughney. These two bands match those in lane 56A-69A. The final match denoted on this particular locus was the match between 56A-69A and DNA profile found in lane 135 which is lane #19, the male fraction of the body swab reportedly from Linda Daughney. To summarize there is now a match between exhibit 1(i) and the DNA profile found in 56A-69A; a match between 1(j), the DNA profile found in 56A-69A; there is an inconclusive result with respect to exhibit 109. Again the DNA found in that particular swab, the vaginal swab reportedly from Donna Daughney, the only DNA pattern that I can see or recognize is consistent with having arisen from the same individual who has donated exhibit 115(b) which is the known blood sample reportedly from Donna Daughney. There is a match between exhibit 110 and exhibit 56A-69A and again there is a match between exhibit 135 and exhibit 56A-69A and this match is the locus D4S139.

Q. At this point in time what conclusions can you draw from those matches?

A. From these matches alone one can conclude that one cannot distinguish the profiles found in these particular lanes and that they could have arisen from a common source, but they are consistent with having a common source.

Q. What, if any, reservations do you have with respect to the calls that you have made in relation to this particular autorad?

A. I have no reservations with respect to this particular autorad. The one thing you may note with this particular autorad is that some of the marker bands have increased intensity as compared to previous autorads. This is a function of the probe pH30 for locus D4S139 that at that time it actually bound sequences that were homologous to it within the markers. These sequences are vector sequences for simplicity sake. It is part of the way this particular marker system was developed and it happened to have homologous sequences to the probe itself. In this next slide,although these results are much fainter as compared to the matches, one can see that the probe itself has been altered slightly so that it does not react with our marker system.

Q. Would you explain to the judge please and the court what this next slide represents?

A. This next slide represents a reprobing of the same membrane with that particular locus D4S139.

Q. Was this reprobing done immediately after the first probing of this probe?

A. No. This reprobing was done at a much later date.

Q. Do you have this particular slide or this autorad on the light box? (pause) What was the purpose, Doctor, of reprobing?

A. The purpose for reprobing in this particular case was to show that the results obtained with the original form of pH30 for locus D4S139 would give the same

results as the later developed probe pH30 which is for locus D4S139; in order to show that in fact the probe does not any longer bind to marker sequences and yet it gives the same polymorphic results for all the lanes we have described previously.

Q. What, if any, concerns did the reprobing raise in relation to the first probing?

A. I have no concerns whatsoever on the matches called by my first probing.

Q. Does this second probing in any way affect your opinion --

A. No, it does not.

Q. --in relation to the calls you made on the first probing?

A. It just confirms my opinion made on the first probing.

Q. Thank you, Doctor.

THE COURT: Would you just indicate on this slide the matches?

A. The matches on this slide are much fainter because it is a probing that was done at a much later date, but the matches that can be readily seen without straining one's eyes too much is the match between exhibit 56A-69A. You can barely see the two bands in exhibit 1(i). The two bands in exhibit 1(j). I think it is too faint on this slide to see the match there in exhibit 110 but one can readily see the match with exhibit 135 between 56A-69A.

Q. I will get you to just back that slide -- back it up to the previous slide of the same probing.

A. The matches are much sharper and cleaner on this particular probing. The reason for that is simply the fact that this membrane, at that point, had been

probed ten, eleven times. With each subsequent stripping of the membrane there is some loss of DNA. Therefore the sensitivity is decreased. The matches are between 56A-69A, 1(i), 1(j), 110 and 135.

Q. Your reasons for calling 109 inconclusive?

A. 109 inconclusive is that I cannot attribute any pattern to anyone other than the donor of exhibit 115 which is the known blood sample reportedly from Donna Daughney.

Q. Okay.

A. This next locus is D17S79. What one will notice immediately is that there appears to be extra bands in many of the lanes as compared to the stronger bands in the lower portion of the gel. Most of the bands found with this particular locus are in the lower quadrant of the gel.

Q. You know that from what?

A. I know that from personal experience and from the date of this.

Q. And from what?

A. The date of this. What these bands are are incomplete stripping of the membrane from the previous hybridizations with pH30. D4S139. This is due to the fact that D4S139 is a very sensitive probe that binds very strongly to the membrane and sometimes it is very difficult to remove that probe from the membrane. One can simply confirm the fact that this is from the previous probing by superimposing one autorad on top of the other and one can see that the bands in fact are the same. That is a simple way to confirm where these bands have arisen from.

Q. Is there any other way of confirming it, Doctor?

A. There is another way of confirming it is by simply stripping this membrane and reprobing it again.

Q. Did you in fact do it?

A. That has been done. The matches called on this particular hybridization are the match between exhibit 56A-69A, these two bands, the known hair standard reportedly from Legere, and the match called was between exhibit 56A-69A and exhibit 1(j). Now, it is apparent from this particular probing that the bands found in 1(i)F, 1(i), 1(j)F and 1(j), 56A, all appear to match visually. The reason that I have only called the match between exhibit 56A-69A and 1(j) is for the simple fact that I know that from previous probings I have seen DNA, female DNA, in fraction 1(i)F that has been carried over into fraction 1(i) for that particular swab reportedly from Nina Flam. Therefore I cannot conclude that this DNA could have come from the donor of the same known sample, 56A-69A,or the donor of exhibit 1(i)F, reportedly from Nina Flam. I cannot differentiate between the two individuals. From previous experience with this particular membrane and previous probings I have seen that I have a very clean separation of DNA from exhibit 1(j)F and exhibit 1(j) which again is a vaginal swab reportedly from Nina Flam. In this case I was able to completely separate the female fraction, the vaginal epithelial cells, from the male fraction and I am of the opinion that the DNA seen in this particular probing is contributed by a male and only a male. Therefore I conclude that it

matches the individual seen in exhibit 56A-69A. This again is an example of what we are really trying to do with this matching and the comparisons that we are doing. We are fully aware that individuals will share the same profile and that is the entire purpose of contructing a database so that we can see the frequency of a coincidental match across the population.

Q. What does that tell you about the band patterns at this locus, D17S79, as between Nina Flam and the sample reportedly coming from Legere?

A. It tells me that they share the same pattern at this particular locus. Again we have seen at other loci they do not share the same pattern.

Q. Is that a surprising conclusion for you to arrive at?

A. Not at all, no.

Q. The other match called for this particular probing was the match between exhibit 56A-69A and the band seen in exhibit 135. The male fraction of the body swab reportedly from Linda Daughney denoted at lane #19. A match between lane #3 and lane #19. There are two bands here. This is not a band. That is non-specific binding. These two bands and these two bands. (indicating)

Q. What, if any, reservations do you have about the calls you have made in this particular probe?

A. I have no reservations. This next slide is simply a reprobing of that same membrane -- same probe. Again it is a much cleaner background although it is a fainter representation of the previous one. One can see the match between exhibit 56A-69A, the match in exhibit 1(j) -- although it is very faint on this representation.

Q. Doctor, this particular reprobing, was this done immediately after the first one, D17S79?

A. No, it was not. It was done at a much later date.

Q. Would there have been any probings have taken place between the times?

A. I would have to check my notes to see how many were done. The match between exhibit 56A-69A and the match with exhibit 1(j) and again the match with exhibit 56A-69A and the bands found in exhibit 135. One would have to really look at the original in this particular case to see those bands properly. The importance of this, the reason this was done, was to show that the upper bands were not specific for this particular locus. That in fact they were derived from the previous probe.

Q. If you could perhaps back it up so we can see the difference.

A. These particular bands were non-specific for this locus.

Q. Go forward please.

A. The bands at the upper quadrant of the membrane are not there.

Q. What, if anything, does that confirm for you?

A. It just confirms that all the bands, the extra bands in the first hybridization with this probe were due to inefficient stripping of the membrane.

Q. If you would, Doctor, go to the chart and just summarize your findings.

A. The findings with locus D17S79 were that it was inconclusive for exhibit 1(i) for the reasons I have explained and the fact that I could not attribute the

DNA as nothaving come from the same individual as the donor of the vaginal swab. There is a match between exhibit 1(j) and exhibit 56A-69A. For exhibit 109 there are no bands that cannot be attributed to the donor of that particular swab and in exhibit 115B which is the known blood sample reportedly from Linda Daughney -- Donna Daughney. Excuse me. That there was an inconclusive result found with exhibit 110. In fact again one does not see bands in that lane. There was a match between the DNA profile found in exhibit 135 and the DNA profile in 56A-69A.

Q. The fact that you have found a visual match is consistent with what?

A. At this particular locus it is consistent with having derived from the same source.

Q. Put the original on the light box, Doctor. You have a slide up now. D16S85.

A. That is correct. This is the first probing with the locus for D16S85. One can see there are very faint patterns and often fairly blurry results seen with this particular hybridization. For those reasons, even though there appear to be bands that one might be able to score, I called the entire probing inconclusive. The reason I justify that is I cannot see any reason in any of the lanes to exclude the patterns or partial patterns I see -- to exclude the donor of 56A-69A as being a potential donor for those patterns. I can't see any reason to exclude them. Therefore I can't include them. Therefore I call it inconclusive.

Q. I take it then that this particular probe was not used in the final calculations of statistical significance?

A. No, it was not. This is a second probing with that particular locus. Again the results are somewhat faint and fuzzy but again I cannot exclude the donor of 56A-69A as being a potential donor for any of the bands I can see in this particular probing. Therefore we took the conservative measure and called it inconclusive. This is the original of what is seen on the screen.

Q. You have put it on the light box.

A. I put it on the light box. Thus with this particular probing I have called all the comparisons inconclusive. D16S85.

Q. Just for the record, the autorads you have put on the screen to this point are included in VD-55, the first section.

A. That is correct.

Q. The duplicate autorads.

A. That is correct.

Q. Continue.

A. This next slide is for locus D10S28.

Q. You are putting the original on the light box.

A. That is correct. Unfortunately this again is not the best representation. One would really have to refer to the original autorad to see these bands clearly. They are fairly faint, but I think it is sufficient to see several of the matches I have called with this particular locus. The match I have called is between exhibit 56A-69A, lane #1, and

exhibit 1(j). You can see the band there and the band there. (indicating) -- which is --

THE COURT: 10.

A. Lane #10. Yes. Thank you, My Lord. The vaginal swab -- the male fraction of the vaginal swab reportedly from Nina Flam. The next match that I called on this particular locus is the match between 56A-69A and exhibit 110. With this representation you cannot really see the lower band. One would have to refer to the original autorad.

Q. Which is presently on the light box.

A. Which is presently on the light box. This is the male fraction of the body swab reportedly from Donna Daughney. It is lane #14. And the third and final match called with this particular locus is the match between exhibit 56A-69A and exhibit 135. This one is fairly easily seen match on this particular slide. And this is the body swab reportedly from Linda Daughney. It is lane #19.

Q. Do you have another of that D10?

A. I do not believe so. No.

Q. Go to the chart, Doctor.

A. For this particular locus the result with the comparison 56A-69A and exhibit 1(i) there are no bands that I can attribute/have to come from any other individual other than the donor of the swab which is visualized in exhibit 1(i)F. You can see the bands that match that same individual and we know from previous experience with the hybridizations with this blot that there is some carryover of that female fraction. There is no band that matched those

of exhibit 56A-69A. Therefore it is ruled inconclusive. There is a match between 56A-69A and exhibit 1(j). Again with exhibit 109 one can only see bands that match those of the donor of exhibit 115 which is a known blood sample reportedly from Donna Daughney. With exhibit 110 one can see the match between exhibit 56A-69A,and exhibit 135 one can see the match between exhibit 56A-69A.

Q. You indicated I believe 110, the slide -- which would be better to look at? The slide or the original autorad?

A. It is always better to look at the original. These are just for demonstrative purposes only. If one wishes to make an interpretation one always uses the original.

Q. What, if any, reservations do you have with respect to the call you have made?

A. I have no reservations with respect to these calls.

Q. And what, if any, conclusions can you draw from the fact of the matches that you have called?

A. The matches that I have called for the individual probings seem to indicate that there is a common source for these particular samples.

Q. Okay, Doctor. You have put up in the slide D722.

A. Yes.

Q. You are putting the original on the autorad.

A. On the light box?

Q. Excuse me. On the light box.

A. Yes.

Q. And the duplicate original of this particular autorad is set out in VD-55, the first section.

A. Yes. This is a control probe, the monomorph, as it

has been commonly termed. What we see is every individual in the population have a common band. This common band is 2731 base pairs. If there is sufficient DNA in that lane this particular locus will light up a band at 2731 base pairs. There are other bands that have been lit up by this particular probe. They have not been sequenced. Therefore we do not use them as a control or band shift or any anomalies in the gel.

Q. Okay. Perhaps I could ask you then if you could just refresh our memories with respect to why a monomorphic probe is used, what is the purpose and what conclusions you drew from reading this particular autorad?

A. The monomorph is just to show that there is no difference between the various lanes in the gel in the way that both samples ran. For example, ethidium bromide has been known in some cases to cause shift in a particular lane. One can determine the precision of the results by comparing the way the monomorph ran in this particular gel and one can also determine the accuracy of the results because this is a known size fragment and one can determine the size using the computer to see how accurate the results are with respect to the known size for that fragment.

Q. What, if any, conclusions did you draw from reading this particular autorad?

A. That the results obtained are within the measurement imprecision of the technology. That they are both precise and accurate for this particular gel.

Q. What, if any, band shifting did you observe from reading this particular autorad?

A. There is no observed band shifting on this particular autorad.

Q. What, if any -- from reading this particular autorad what, if any, concerns did it raise in you with respect to the calls you made on the highly polymorphic markers?

A. It confirms the calls in the sense that it is a control and it tells me that the results that I have called before were accurate and precise.

Q. Thank you, Doctor.

A. I believe this is a second exposure of that particular hybridization. It shows a little more clearly the fact that these are not overexposed and are run in a fairly straight line.

Q. This slide here, Doctor, did this cause you any concerns with respect to the calls you previously made?

A. No, it does not. It is just a second exposure. Frankly there is no necessity to really show it. It just happened to be in the exhibit that was submitted.

Q. Go to the summary chart please and tell us what conclusions or what summaries you can make with respect to the monomorphic probe?

A. With respect to the monomorphic probe I have denoted on this particular chart locus D7Z2, a plus sign simply means that the monomorph has been detected in those particular samples and it has been detected as being within the range of measurement imprecision. Therefore we have a plus for exhibit 1(i), 1(j), 109, 110 and 135. Now, the monomorph is one of our most

sensitive probes for reasons of the number of copies found in each chromosome and it is also used as a control for the sex typing.

Q. Explain that please.

A. Well, perhaps be easier to explain when we get into the sex typing.

Q. Fine. You have put a slide up. DYZ1.

A. That is correct. That is for the male sex chromosome. DYZ1.

Q. You are referring to the chart, VD-27.

A. That is correct.

Q. You are putting the original of this on the light box?

A. Yes, I am.

Q. And this again for the record is a duplicate original of the autorad being put on the light box or contained in VD-55, the first section?

A. That is correct. DYZ1 is our most sensitive probe.

Q. Is this the sex typing probe?

A. This is the sex typing probe. What one should see is a band approximately 3564, of this size, in any male DNA present on that particular membrane.

Q. 3564. What measurement is that?

A. Base pairs. When one doesn't see a signal then one can assume that there is either not enough DNA present in that sample to detect the male DNA or that in fact this is DNA that has been donated by a female. When I said that the monomorph, locus D7Z2, is a control for the sex typing probe, the fact that one can see a band with the monomorph and not with locus DYZ1 indicates that the DNA found in that particular lane is from a female. The other control

we have for this particular locus is NM. This is a blood sample from a female and we should always obtain an negative result with this particular probing.

Q. Now, from a female. Is this a standard used by the lab or --

A. This is a standard that was used at the time in the R.C.M.P. lab, yes. The other standard is the male control, L2, in lane #21, which, of course, if this probe is working and functioning in the proper manner, should give you a band of 3564. Therefore we have positive and negative control for the sex typing.

Q. What, if anything, from reading this particular sex typing probe would -- what, if any, conclusions did you draw with respect --

A. I concluded that, of course, as expected the DNA from exhibit 56A-69A was derived from a male and this is a known hair sample reportedly from Legere. That there is DNA found in exhibit 1(i) which is the vaginal swab reportedly from Nina Flam, the male fraction in lane #7. Again there is DNA present from a male. In exhibit 1(j), which is the male fraction of the vaginal swab from Nina Flam found in lane #10, again is derived from a male. And for the first time I have seen DNA in exhibit 109 which could not have been derived from the same individual as lane #115B. The donor of that sample is reportedly Donna Daughney who is a female. Therefore there is no male component in that DNA and yet in this vaginal swab, for the first time, I have seen DNA that could not have come from that individual and it is from a

male. Since it is our most sensitive probe the amount of DNA indicated there is that I would probably not be able to see male DNA in our polymorphic systems. There is just not enough DNA for those polymorphic probes to light up any bands.

Q. But you can draw a conclusion that there is DNA in that.

A. I can draw the conclusion that there is some male DNA in that particular sample. I cannot attribute it to any source.

Q. 109 is what, Doctor?

A. Exhibit 109 is the male fraction of the vaginal swab reportedly from Donna Daughney.

Q. Continue please.

A. There is male DNA in exhibit 110 which is the male fraction of the body swab reportedly from Donna Daughney, lane #14. There is a very strong male fraction in exhibit 135 which is the male fraction of the body swab reportedly from Linda Daughney. You will notice from the matches that have been called previously that the most matches between exhibit 56A-69A are with exhibit 135 and this can be simply attributed to the fact that there is a larger amount of DNA in this particular sample. Therefore one can visualize bands more readily with the polymorphic system used.

Q. What, if any, -- from reading this particular probe what, if any, reservations do you have with respect to the calls that you made on the previous probes?

A. I have no reservations whatsoever on the calls I have made.

Q. If you would go to the chart, Doctor.

A. Again with this chart I have designated locus DYZ1. A plus sign simply indicates that male DNA was present in that particular sample and these are exhibits 1(i), 1(j), 109, 110 and 135. All contained male DNA.

Q. Okay.

A. That concludes all the probings for that particular membrane.

Q. I will ask you if you would, Doctor, to -- what, if anything, did you do with respect to the conclusions you drew -- the visual conclusions that you drew from looking at these particular autorads from that membrane?

A. These autorads were all scanned using the computer and a size for each of the fragments matched was obtained.

Q. If you would -- perhaps we will turn the lights on for the moment. You have indicated that -- sorry. If you would just repeat so I don't misquote you. What did you actually do? Apart from the visual matching what did you do then?

A. The match was confirmed using the computer by obtaining a size for each of the fragments and determined whether it was in our match window.

Q. And did you actually do that? Have that generated?

A. Yes, I did.

Q. I will refer you to what has been marked on this hearing as VD-66. Would you tell us what that represents?

A. This is the computer-generated calculated fragment

lengths for that particular autorad. It is in particular for locus D1S7.

Q. D1S7. And that is with respect to -- on your summary chart this would be in relation to this particular summary here.

A. That is correct.

Q. What, if any conclusions did you draw with respect to the visual matches you called from the computer quantification?

A. The computer quantification confirmed the visual match.

Q. I show you VD-67. Would you look at that for me please, Doctor, and tell me whether you can identify that?

A. This is the computer generated calculated fragment lengths for locus D2S44 for the membrane that we have been talking about.

Q. And from your summary chart that would be in relation to the matches or it would be in relation to this particular summary here, D2S44?

A. Yes, it would.

Q. What, if anything, did the computer quantification tell you in relation to the visual call that you made?

A. The computer generated data confirmed the visual matdh.

Q. I refer you to VD-68 please. Tell me please what that is.

A. This is the computer generated calculated fragment lengths for locus D4S139 for the blot that we have been describing.

Q. That is in relation to your summary chart, this particular area marked under D4S139?

A. That is correct.

Q. What, if anything, did this computer quantification tell you in relation to the visual matches that you declared at that particular locus?

A. The computer quantification confirmed the visual match.

Q. Pardon? Sorry.

A. The computer quantification confirmed the visual match.

Q. I refer you to VD-71 please. Tell me what that is.

A. This is a computer generated calculated fragment lengths for locus D17S79 as denoted on this chart in this particular lane.

Q. What, if anything, did the computer quantification of the visual matches that you called in relation to D17S79, what, if anything, did that tell you?

A. It confirmed the visual match.

Q. VD-69 please, Doctor?

A. This is a computer generated calculated fragment lengths for locus D10S28 as described in the chart here for the matches described here.

Q. On the summary chart.

A. On the summary chart, yes.

Q. And what, if anything, did the computer quanitification set out in that particular document tell you about the visual calls that you made in relation to D10S28?

A. It confirmed the visual match.

Q. With respect to D16S85 you have shown in your testimony and on this visual chart, you have shown them all to be inconclusive.

A. That is correct.

Q. Did you in fact size those in any event?

A. Yes, I did.

Q. I refer you to VD-70.

A. This is a computer generated calculated fragment lengths for the locus D16S85.

Q. There was no matches called in that particular --

A. That is correct.

Q. Doctor, with respect to the computer quantification backing up your visual matching, as you have summarized in this particular chart, what -- when you say that it confirmed it, what does confirming it mean? What are you looking for when you are computer quantifying your visual calls?

A. The confirmation of the visual call is done by first allowing the computer to estimate the fragment sizes seen for each of the bands in those lanes and to determine whether these bands or fragment sizes fall within our match window.

Q. Your match window is what?

A. Our match window is 5.2 per cent.

Q. When you say 5.2 per cent what do you mean by that?

A. That is the difference between the known sample and a questioned sample divided by the size of the known sample.

Q. Would you tell the court please whether or not the matches that you have declared visually, whether or not those matches that you have set out in your summary chart fell within the matching window?

A. They all fell well within the matching window.

Q. I don't know if you did or not, Doctor, but have you done any individual -- are you able to, at this point

in time, able to tell the court the actual percentage for each match?

A. Yes, I can.

Q. Perhaps, Doctor, if I could ask you -- and correct me if I am taking you through this in the wrong fashion. Would you please tell the court the percentage, within the match window, that you found or the computer quantification showed you, between the match that you called the D2S44 between the sample 56A-69A and the sample 135?

A. The difference in those samples was for one band +1.4% and the second band was +0.7%.

Q. And your match window is 5.2 per cent.

A. That is correct.

Q. And what does that indicate to you?

A. That these samples are well within our match window.

Q. That is the sample 56A-69A purportedly coming from Legere, and the sample purportedly coming from --

A. -- the body swab of Linda Daughney.

Q. Doctor, if I could do the same please with D1S7 on the summary chart? If you could tell me what the percentage -- within the match window -- in relation to 56A-69A and 1(j)?

A. Again there are two bands. The first band, the higher molecular weight band, is -0.9% and the lower band is -1.4%.

Q. What does that tell you in relation to your 5.2 per cent matching window?

A. That these again are well within our 5.2 per cent matching window.

Q. And that would be between the sample purporting to come from Legere and the sample purporting to come from the male fraction of Nina Flam's vaginal swab.

A. That is correct.

Q. Under D1S7 would you tell us please in relation to the matchin between 56A-69A that you called and item 135, where that fell within the match window?

A. Again there were two bands. The higher molecular weight band, the difference was 0.1% and for the second band there was no difference.

Q. What, if anything, does that tell you in relation to your match window?

A. That tells me again it is well within our match window.

Q. Doctor, if I could take you to D4S139 and the match that you summarized here on the chart between 1(i) and 56A-69A.

A. Again there are two bands. The higher molecular weight band is +1.1% and the lower molecular weight band is +0.9%.

Q. That is in relation to the match you declared between 56A-69A purporting to come from Legere and the male fraction of Nina Flam's vaginal swab.

A. That is correct.

Q. The next would be 1(j) and 56A-69A and D4S139.

A. That is correct. The difference for the higher molecular weight band is +0.7% and the lower molecular weight band is +0.6%.

Q. What does that tell you with respect to your match window?

A. That it is well within our match window.

Q. That is between the sample purporting to come from Legere and the sample -- the male fraction purporting to come from Nina Flam's vaginal swab.

A. That is correct.

Q. Doctor, if we could go to the next one please. The match that you called between 56A-69A and 110. 110 being the male fraction of a body swab from Donna Daughney.

A. The difference for the high molecular weight band for locus D4S139 was +0.2% and the low molecular weight band was +1.2%.

Q. What does that tell you with respect to your match window of 5.2 per cent?

A. Again it is well within the match window.

Q. If I could take you please, Doctor, to the match under D4S139 between 56A-69A and 135?

A. Again for the high molecular weight band or fragment the match was +1.1%. For the low molecular weight fragment it was +1.3%.

Q. What does that tell you in relation to your match window of 5.2 per cent?

A. Again it is well within the match window.

Q. I ask you to go to D17S79 and the match you have declared between 56A-69A and 1(j). Would you tell us what the computer quantification told you?

A. The computer quantification told me that for the high molecular weight band the difference was -1.7%. for the low molecular weight band it was -1.6%.

Q. And what is that in relation to your 5.2 per cent matching window?

A. It is well within the matching window of 5.2 per cent.

Q. D17S79, the match you declared between 56A-69A and 135.

A. The match for the high molecular weight band was -0.1%. The low molecular weight band was +1.5%.

Q. What does that tell you with respect to the match window of 5.2 per cent?

A. That again is well within our match window of 5.2 per cent.

Q. Doctor, go please to D10S28 and the match you have declared between exhibit 1(j) and 56A-69A.

A. The match for the two bands again is for the high molecular weight fragment there is no difference. For the highi molecular weight band the match is -0.5%.

Q. What does that tell you with respect to the 5.2 per cent match window?

A. It tells me it is well within our match window.

Q. And the match under D10S28 between 56A-69A and 110?

A. The match for the high molecular weight fragment is -0.4% and the low molecular weight fragment is -0.7%.

Q. What does that tell you with respect to the match window of 5.2 per cent?

A. That again is well within our match window.

Q. And the match finally under D10S28 between 56A-69A and 135?

A. The match for the high molecular weight fragment is +0.5% and the lower molecular weight fragment is +0.3%.

Q. What does that tell you with respect to your match window of 5.2 per cent?

A. It is well within our match window of 5.2 per cent.

Q. Just to clarify, Doctor, you are talking plus or minus.

Your 5.2 per cent -- correct me if I am wrong -- is 2.6 per cent plus or minus? Or is that the wrong way to look at it.

A. That is the wrong way to look at it actually.

Q. Describe it then please.

A. The way it is designed is that the two samples have to be within 5.2 per cent of each other using the size determined for the known sample as the standard.

Q. Dr. Bowen, what in fact did you do next in relation to this particular blot?

A. I then referred the data that I had obtained between these matches for the size fragments obtained from the computer and referred to the database for the Caucasians that has been generated by the R.C.M.P. to bin the particular fragments observed.

MR. WALSH: My Lord, at this time, if the court wishes we could break if you wish.

THE COURT: Yes. Let's have a fifteen minute break now.

(RECESS: 11:00 - 11:25)

THE COURT: Mr. Walsh.

MR. WALSH: My Lord.

Q. Doctor, I believe just before the break you indicated that you were moving to the area of the statistical significance that you attributed to the matches; am I correct?

A. That is correct.

Q. Tell the judge please and the court what you actually did in this regard.

A. First I took the measurement -- the calculated measurement of the fragment lengths from the computer

and after having determined that they were within out match window, I binned the data, the fragment sizes derived from those calculated fragment lengths, into the appropriate bin in our Caucasian database.

Q. Now, was that the rebin data tables I showed you yesterday?

A. That is correct.

Q. Perhaps at this time, if I could mark the summary chart, if that would be agreeable, with an exhibit number.

THE COURT: Yes. It is not a pure exhibit. It is more of a reference exhibit I suppose but it is appropriate I think that it go on to evidence. VD-88. Mr. Walsh, you don't have a condensed version of that.

MR. WALSH: No, I am sorry. I don't, My Lord.

THE COURT: Would it be difficult to produce?

MR. WALSH: No. I think we could probably draft something and file it with the court before the end of the week if that is agreeable.

THE COURT: Yes. I would think it would be easy reference and Mr. Furlotte -- defence counsel would appreciate one too perhaps.

MR. WALSH: Yes.

THE COURT: You have another summary chart do you for --

MR. WALSH: No, My Lord. This is the only summary chart that we will need.

Q. Doctor, I am going to show you the item that has been marked on this hearing, 64. Would you look at that for me please and tell me whether you can identify it?

A. Yes. This is the rebin data that I used for this particular case.

Q. What are you getting out of the rebin data? What are you trying to determine from this?

A. The rebin data tells me the frequency of any of the size fragments that I obtained in this particular case.

Q. The individual band frequency?

A. The individual band frequencies.

Q. What do you do next, Doctor?

A. I then, after binning it -- of course, to bin it I use the plus or minus 2.6 per cent measurement imprecision to determine whether it would actually fall in a more common bin. Having done that I assign a frequency to each of the alleles and using the Hardy-Weinberg equilibrium, the algebraic expression of the Hardy-Weinberg equilibrium, 2pq for a two band pattern, I multiply the frequencies of the individual bands for each particular locus times two to achieve a frequency for that particular locus of that pattern.

Q. Frequency for that probe. Is that another way of --

A. Locus. For that particular probe, yes.

Q. And then what, if anything, did you do, Doctor?

A. If there are matches across several loci then I use the chain rule or the product rule to multiply the frequencies for each individual locus times one another to achieve an ultimate frequency for that particular match across several loci.

Q. I refer you to VD-54 and I -- would you look at that for me please and tell me whether or not the conclusions

you drew from using that particular -- that method of calculation, whether or not they are set out in that particular report?

A. Yes, they are.

Q. If you would, please, for the judge and the court, if you would tell us please what conclusion you drew with respect to the statistical significance -- I am referring to VD-88 now. -- the statistical significance between the match that you drew at D2S44 -- which would be the best way for you to actually do this, Doctor?

A. Either report it as estimated -- frequency estimated based on all the matches for each probe system used for each exhibit.

Q. Fine. Perhaps if I ask you then, Doctor, the match that you drew on exhibit 1(i) and 56A-69A at D4S139 across all the loci you drew one match; is that correct?

A. That is correct.

Q. What statistical significance did you associate with that match?

A. The match for the DNA typing profile obtained from exhibit 1 where D4S139 matches that of exhibit 56A-69A indicates that the source of the DNA is consistent with having originated from the donor of exhibit 56A-69A. The estimated frequency of occurrence in the Caucasian population is less than one in 68 male Caucasian.

Q. And we are referring to the match between 1(i) and 56A-69A.

A. That is correct.

THE COURT: What page of VD-54 are you -- Have you got that set out in VD-54?

A. Page 5.

THE COURT: Yes.

Q. The match you have declared between exhibit 1(j) and 56A-69A across four loci being D1S7, D4S139, D17S79 and D10S28, could you tell us please, using that mathematical calculation what statistical significance you arrived at?

A. For the DNA typing profile obtained from exhibit 1(j) where the match is between exhibit 56A-69A for loci D1S7, D4S139, D10S28 and D17S79, the possibility that that came from a source other than the donor of exhibit 56A-69A is remote. The estimated frequency of occurrence in the Caucasian population is less than one in 5.2 million male Caucasians.

Q. If I could ask you, Doctor, please if you would refer to the matches that you called between exhibit 110 and 56A-69A across two loci being D4S139 and D10S28.

A. For the DNA typing profile obtained from exhibit 110 which matches exhibit 56A-69A at loci D4S139 and D10S28 indicates that it is consistent with having come from the same individual as the donor of exhibit 56A-69A. For example, the estimated frequency of occurrence in the Caucasian population is less than one in 7,400 male Caucasians.

Q. Doctor, the statistical significance that you arrived at with respect to the match that you have declared between exhibit 135 and 56A-69A across five loci. Would you please tell us what your conclusions were?

A. For the DNA typing profile obtained from exhibit 135

which matches the profile of exhibit 56A-69A at loci D1S7, D2S44, D4S139, D10S28 and D17S79, the possibility that that having come from another individual other than the donor of 56A-69A is extremely remote. For example, the estimated frequency of occurrence in the Caucasian population is less than one in 310 male Caucasians.

Q. 310 male Caucasians or-- how many?

A. Oh, excuse me. 310 million male Caucasians.

THE COURT: As C. D. Howe said, 'What is a million?'

Q. What, if any, reservations do you have with the conclusions you have drawn?

A. I have no reservations with the conclusions drawn.

Q. Could you tell us please what, if anything, you did next in relation to -- what, if anything, you wish to provide evidence on next in relation to any sample that you actually ran in the RFLP typing process?

A. A second blot was run with regards to this particular case. It contained samples that were known samples reportedly from Mr. Legere.

Q. Do you have them on slides?

A. Yes, I do.

Q. Do you wish to refer to them?

A. Yes.

Q. Doctor, you have on the screen a slide, D2S44.

A. Yes, I do.

Q. I will show you exhibit VD-55, the second part of VD-55.

A. The second part of exhibit VD-55 contains the duplicate autorads of gel 2, membrane #2, which is the gel that

-- the autorad which I am showing on slides here. The individual lanes, lane #1 contains a marker. Lane #2 contains DNA extracted from exhibit 335 which was the blood on toilet tissues reportedly from Legere. Lane #3 contains DNA extracted from the cell line control, the allelic control, L1. Lane #4 contains DNA extracted from exhibit 83A which is a pubic hair standard reportedly from Mr. Legere. The fifth lane contains DNA extracted from the female allelic control designated NM. The sixth lane contains the DNA marker.

Q. What, if any, conclusions did you draw from this particular autorad?

A. This particular autorad, there is a visual match, of course, between the known standards exhibit 335 and 83A and on gel to gel comparison the known samples, exhibit 335 and 83A, match the known sample exhibit 56A-69A on the previous gel.

Q. That is the first blot, the one you have summarized on the summary chart?

A. That is correct.

Q. What conclusions can you draw from that?

A. The conclusions drawn from that is that they are consistent with having come from the same source.

Q. This match at this point in time, what kind of match are you making?

A. First an internal visual comparison with the sample on this particular blot and a gel to gel comparison, a visual comparison, with the samples on this blot and the previous blot for the same probe system.

Q. Continue please, Doctor.

A. This next slide represents the locus D10S28.

Q. You are now putting the original on the light box.

A. Yes. Again there is a visual match between exhibit 335 and exhibit 83A. 335 being the blood stain from the toilet tissue and 83A the known pubic hair sample reportedly from Legere.

Q. What, if any, matches did you make other than lane to lane within that particular blot?

A. These were compared visually gel to gel to the first membrane I discussed and have indicated that there is a visual match between 56A-69A, the known hair sample reportedly from Legere.

Q. What, if any, reservations do you have about that particular opinion?

A. I have no reservations about that opinion.

Q. Continue please.

A. This next hybridization indicates the locus D1S7.

Q. You putting the original on the light box?

A. Yes. Again there is a match between the blood reportedly from the toilet tissue reportedly from Legere,exhibit 335, and the known pubic hair sample reportedly from Legere, exhibit 83A. There is a visual match between the bands.

Q. Apart from the lane to lane comparisons what, if any, other comparison did you make?

A. The visual comparisons made between this particular gel and the previous gel, membrane #1, to show that there is a visual match between 56A-69A and the two known samples on this gel, exhibit 335 and 83A.

Q. Continue please.

A. This slide represents the autorad for locus D17S79.

Q. You are now putting that original on the light box.

A. Yes, I am. Again there is a match between 335, the blood stain from the toilet tissue reportedly from Mr. Legere, and the known pubic hair sample, exhibit 83A, reportedly from Mr. Legere.

Q. What, if any, other comparison did you make?

A. A visual comparison was made between this membrane and the first membrane shown previously to show that there is a visual match between the bands in exhibit 335 and 83A to the known hair sample, exhibit 56A-69A, reportedly from Legere. This next slide is for locus D16S85. Again there is a visual match between exhibit 335, the blood stain reportedly from Mr. Legere, and the pubic hair sample reportedly from Mr. Legere. It is very faint in this particular slide. It is actually very faint on the original autorad. I confirmed this match by reprobing the membrane in order to determine whether the bands could be visualized better. Unfortunately the slide is not much better than the first slide but on the original autorad it is quite better to see that there is a visual match between these samples.

Q. D16S85, that is the probe you called inconclusive on the first blot.

A. That is correct. There was no call ever made on this particular probe.

Q. Refresh our memory with respect to the sensitivity of that probe?

A. It is probably our least sensitive probe.

Q. Continue, Doctor.

A. This next slide represents the slide of the autorad for locus D4S139. Again there is a visual match between exhibit 335 and exhibit 83A, both known samples reportedly from Legere. Again on this representation the slide is fairly faint. It is much better in the original autorad.

Q. What, if any, comparisons did you make other than within this particular blot?

A. There was a blot to blot comparison. It was compared visually to the original membrane #1 and showed that there was a visual match between exhibit 335 and 83A and the known hair sample 56A-69A, hair sample reportedly from Mr. Legere.

Q. Continue please.

A. This next slide shows the results from the monomorphic probing, locus D7Z2.

Q. You are putting the original on the light box?

A. Yes, I am. Again this is a monomorphic probe. We see a band of 2731 base pairs which indicates that the results are precise when comparing one lane to another and that in fact they are accurate.

Q. What, if any, band shifting can you observe?

A. There is no indication of band shifting.

Q. Explain, Doctor, that lane 335. There appears to be a band underneath.

A. There is an extra band here that is seen in approximately ten per cent of individuals. I have shown on the original autorad that there is actually many bands that can be visualized using this probe. This particular probe has been sequenced for this particular band fragment. Dr. Waye actually did the

sequencing and published the results. He cloned this particular probe during his time at university. The only band that we used for our specific purposes to detect band shifting is the band 2731 because it has been sequenced. The remaining bands have not been sequenced.

Q. Continue, Doctor.

A. This is the sex typing probe, DYZ1, for that particular membrane. This probe indicates that the DNA extracted from exhibit 335 and 83A comes from a male. This is confirmed by the male control cell line L1 and the fact that there was no band present in the female cell line -- female blood sample designated NM. The band size is approximately 3564 that we use to confirm sex.

Q. That is in base pairs, Doctor.

A. 3564 base pairs, yes.

Q. Anything further with respect to this blot, Doctor?

A. No, I don't believe so.

Q. Doctor, could you explain to the court why -- it may be obvious but just for the -- to ensure that it is clear -- why you did not put 335, the blood sample, or 83A, the pubic hair standard, why that was not run on this particular blot here that you have noted on the summary chart?

A. There are two reasons. The first reason, of course, is that all 22 lanes were employed in the original membrane. Therefore, I could not have added any samples. The second more important reason is that I did not have those samples in my custody at the time that I ran the first blot.

Q. Do you know whether in fact the samples were actually in the police custody at the time you ran your first blot?

A. I do not believe so, no.

Q. If you would summarize, what conclusions can you draw from your findings on the second blot in relation to your findings on the first blot?

A. That the conclusion being that the samples on the second blot, particularly exhibit 335 and exhibit 83A, have originated from the same individual as exhibit 56A-69A and that the matches called for exhibit 56A-69A would also be called for those two exhibits, exhibit 335 and exhibit 83A.

Q. Did you have occasion, Doctor, to back up your visual matching from lane to lane and from gel to gel by computer quantification?

A. Yes, I did.

Q. I refer you to item VD-74 I believe.

A. Yes.

Q. 74. Would you tell me what that is?

A. That is the computer generated calculated fragment lengths for the second membrane/ locus D1S7.

Q. Did you do any calculations in relation -- tell us whether or not your computer quantification, what it told you in relation to the match window?

A. It told me that the matches within the gel and between this gel and gel #1 are within our measurement imprecision window and therefore can be called conclusive.

Q. Your measurement imprecision window. You have told

us that it -- obviously it applies from within a gel -- lane to lane comparisons in a gel. Does it also apply from gel to gel?

A. Yes, it does. It is the same window. It is 5.2 per cent.

Q. Could you tell the court please what, if any -- do you have the actual calculations in terms of per cent?

A. Yes, I do.

Q. -- for that particular probe lane to lane and gel to gel?

A. Yes.

Q. Could you give it to the court please?

A. Within the gel all these calculations, I used exhibit 335 as the known standard. For locus D1S7 for the high molecular weight band it is +1% when compared with exhibit 83A and the lower molecular weight is +1.1%.

Q. And how is that in relation to your match window?

A. That is well within your match window.

Q. Continue please, Doctor.

A. For gel to gel comparisons using 56A-69A as the known sample, for locus D1S7 when compared to exhibit 335 the high molecular weight band is -3.1%. The low molecular weight band is -3.3%. For exhibit 83A the high molecular weight band is -2.1% and the low molecular weight band is 2.2%.

Q. How is that in relation to your match window?

A. That is within our match window of 5.2 per cent.

Q. Continue, Doctor.

A. Those are all the matches for that particular locus.

Q. Tell the court please what, if any, variation would you expect between gel to gel versus lane to lane within the same gel?

A. One would expect that if one is comparing lane to lane in the same gel the measurement imprecision would be that much tighter or closer than one would achieve doing a gel to gel comparison.

Q. I refer you to VD-75. Tell us please what that is.

A. This is the computer generated calculated fragment lengths for the second autorad, locus D2S44.

Q. What conclusions can you draw from that?

A. The conclusions drawn were that for exhibits 335 and 83A on that gel they match. They are within our measurement imprecision window, and that both these samples, exhibit 335 and 83A,on a gel to gel comparison match exhibit 56A-69A on the first gel.

Q. Could you give us the calculations with respect to that window?

A. Yes. For within the gel comparison for the high molecular weight band it is +0.7%. For the low molecular weight band it is +0.6%. For the gel to gel comparison for locus D2S44 for exhibit 335 the high molecular weight band is -1.4%. The low molecular weight band is -1.7%.

Q. How are those calculations in relation to your 5.2 per cent window?

A. They are well within the 5.2 per cent window.

Q. You use the term high molecular weight band and low molecular weight band. To the uninitiated which band are you referring to when you look at an autorad?

A. The high molecular weight band is the band fragment

that is higher in the gel. It is closer to the origin of the gel. When looking at the calculated fragment lengths it is the one with the larger number in base pairs.

Q. If I am looking at the autorad, it is the band that is closer to the top --

A. That is correct.

Q. -- is the high molecular weight band.

A. Yes. For the match between 83A and D2S44 the window was, for the high molecular weight band, -0.8% and the low molecular weight band, -1.1%.

Q. What does that tell you in relation to your match window?

A. Again that is well within our match window of 5.2%.

Q. Anything further on that one?

A. No.

Q. I show you VD-76. Tell us what that document is, Doctor, please.

A. This is a computer generated calculated fragment lengths for the second gel for locus D4S139.

Q. And could you tell us what conclusions you can draw from that?

A. The visual match was confirmed in that exhibit 335 and exhibit 83A both on that same gel match, and that exhibit 335 and exhibit 83A both match exhibit 56A-69A on the original gel number one.

Q. What do the figures tell you in relation to the match window?

A. They are all within the match window.

Q. Could you give us the percentages please?

A. For locus D4S139 the within gel comparison for the

high molecular weight fragment it is +2.1%. The low molecular weight fragment is +2%. For the gel to gel comparison for exhibit 335 the high molecular weight fragment is -3.4%. The lower molecular weight fragment is -2.1%. And for exhibit 83A, gel to gel comparison to 56A-69A, the high molecular weight fragment is -1.5% and the low molecular weight fragment is 0%.

Q. What do those calculations tell you in relation to your 5.2 per cent match window?

A. That they are all within our 5.2 per cent window.

Q. Anything further with respect to this?

A. Not to this locus.

Q. VD-77. Tell us what that is please.

A. This is a computer generated calculated fragment lengths for the second membrane for locus D10S28.

Q. Tell us what, if anything, that document tells you.

A. This document confirms the match between 83A and 335 on the same gel and the match between exhibit 335 and 83A to exhibit 56A-69A on the first membrane.

Q. And what per cent calculations -- what do they tell you in relation to the 5.2 per cent window?

A. They are all well within the 5.2 per cent window.

Q. Could you give us the per cent calculations please?

A. For the within gel comparison the per cent difference between the high molecular weight fragment was +0.8% and the low molecular weight fragment was +0.4%. For the gel to gel comparison for exhibit 335 and exhibit 56A-69A the high molecular weight fragment is -1.9%. The low molecular weight fragment is -2.1%. For exhibit 83A compared to 56A-69A the

high molecular weight fragment is -1.1%. The low molecular weight fragment is -1.7%.

Q. You have indicated that is within the 5.2 per cent matching window.

A. Yes, it is.

Q. Are you finished with that exhibit, Doctor?

A. Yes.

Q. I refer you to exhibit VD-78.

A. This is a computer generated calculated fragment lengths for the second membrane, locus D16S85.

Q. Tell us what conclusions you can draw from that.

A. I concluded that the samples exhibit 335 and 83A match within the gel and that they both match the exhibit 56A-69A on the first membrane.

Q. And the percentage in relation to your match window.

A. The percentage for the within gel comparison is, for the high molecular weight band, +1.0%. The low molecular weight band is +1.2%. For the gel to gel comparison for exhibit 335 and exhibit 56A-69A the high molecular weight fragment is -2.4%. The low molecular weight fragment is -5.2%. For exhibit 83A and exhibit 56A-69A the high molecular weight fragment is -1.5% and the low molecular weight fragment is -4.0%.

Q. What does that tell you in relation to your match window?

A. That they are all within the match window.

Q. Are you finished with that exhibit, Doctor?

A. Yes, I have.

Q. I refer you to exhibit 79 please. Tell us what that is.

A. This is a computer generated calculated fragment lengths for the second membrane for locus D17S79.

Q. What conclusions can you draw from that?

A. I concluded that the match was confirmed between exhibits 335 and 83A on that gel, and that the match between exhibit 335, 83A and 56A-69A on the first membrane was confirmed.

Q. Could you give us the per cent calculations in relation to your 5.2 per cent match window?

A. Yes, I can. Within gel comparison the high molecular weight band was +0.4%. The lower molecular weight band was +0.8%. For the gel to gel comparison with exhibit 335 and exhibit 56A-69A the high molecular weight band is -2.3%. The low molecular weight band is -2.6%. For a comparison between 83A and exhibit 56A-69A, the high molecular weight band is -1.9% and the low molecular weight band is -1.8%.

Q. How does that relate to the 5.2 per cent match window?

A. They are all well within the 5.2 per cent window.

Q. Are you finished with that exhibit, Doctor?

A. Yes, I have.

Q. I refer you to VD-80. Tell me please what that is.

A. This is a computer generated calculated fragment lengths for the second membrane for locus D7Z2.

Q. What, if anything, does that tell you?

A. It shows me that the membrane #2 ran in a precise and accurate way.

Q. What, if any, conclusions can you draw in relation to your match window?

A. That the monomorph was well within our match window. The monomorphic band 2731.

Q. Are you finished with that, Doctor?

A. Yes.

Q. I refer you to exhibit 81. What is that and what conclusions can you draw from it?

A. Exhibit 81 is the computer generated calculated fragment lengths for the second membrane for locus DYZ1, the sex typing locus. It indicates that the size of exhibits 335, the human cell line L1, and 83A is that of a male.

Q. 85, Doctor?

A. This is the calculated fragment lengths for the second membrane for locus D16S85.

Q. What conclusions can you draw from that, Doctor?

A. I concluded from this that -- it is a reprobing of that membrane and I concluded that exhibits 335 and 83A are a match.

Q. Again D16S85 wasn't used in your initial calculations on that first blot.

A. That is correct.

Q. Just before the break, Doctor, I referred you to a number of calculated fragment lengths with respect to the first blot. I believe it went from 66 through to 70. I don't believe I showed you all of them. I note on the table there are some additional ones. I refer you to VD-72. Look at that for me please and tell me whether you recognize that and what it is.

A. This is the computer generated fragment lengths for the first membrane shown for DNA probe D7Z2, the monomorph.

Q. What, if anything, does that tell you?

A. It indicated that the control probing indicated that

the gel ran precisely and accurately. Was well within the measurement imprecision window.

Q. That is exhibit what?

A. VD-72.

Q. I showed you up to 71 this morning before the break I believe. I will show you exhibit 73. Look at that for me please and tell me whether you can recognize that?

A. This is a computer generated calculated fragment lengths for the first membrane for locus DYZ1, the sex typing locus.

Q. What, if anything, did you conclude from that?

A. I concluded from this that exhibits 157A, 56A-69A, 1(j), 109, 110, 135 and the human control cell line L2 contained male DNA.

Q. I am going to show you 82. Would you look at that for me please and tell me if you recognize that?

A. This is the computer generated calculated fragment lengths for the first membrane. It is the reprobing for locus D4S139.

Q. What conclusions can you draw from that?

A. The same conclusions were reached for the original probing of that particular membrane.

Q. Thank you. I show you item 83. That is D16S85. Again D16S85 was not used in your calculations on the first blot.

A. That is correct.

Q. I show you 84. Tell me what it is please.

A. This is a computer generated calculated fragment lengths for the first membrane for locus D17S79.

Q. What conclusions can you draw from that?

A. The same conclusions were drawn from this. This is the reprobing with this particular locus and it confirmed the initial probing.

Q. I am going to refer you to exhibit VD-56. If you would please just explain to the court what VD-56 comprises. There is two sections. Tell us what the first section refers to.

A. The first section refers to a duplicate autorad of a third membrane designated "Gel #3/Membrane #3". This contains known samples reportedly from Legere and several other questioned samples.

Q. Would you tell us what those were, what lanes they were put in and what conclusions you drew?

A. In lane #1 was the DNA marker. Lane #2 was DNA extracted from exhibit 335, the blood stain from the toilet paper reportedly from Legere. Lane #3 was an empty lane. Lane #4 contained DNA extracted from exhibit 84A, a known scalp hair sample reportedly from Legere. Lane #5 contained DNA marker. Lane #6 contained DNA extracted from exhibit GT56B, a known hair sample reportedly from Legere. Lane #7 contained DNA extracted from exhibit 34A, a known hair sample reportedly from Father Smith. Lane #8 contained DNA extracted from exhibit 16, DNA extracted from one root hair reportedly found on the leg of Father Smith. Lane #9 contained a DNA marker. Lane #10 contained the male allelic control designated L1. Lane #11 contained the female allelic control designated NM. Lane #12 the DNA marker.

Q. Item 16, how many hairs did that contain? DNA extracted from how many root hairs?

A. That was DNA extracted from one root hair.

Q. Did you type that using the RFLP typing technique?

A. Yes, I did.

Q. What conclusions did you draw?

A. I reached the conclusion that that particular root hair could not have originated from the donor of exhibit 335 reportedly Legere, or exhibit 34A, the known hair sample reportedly from Father Smith.

Q. Did you have occasion to run any other blots in relation to this particular case?

A. Yes, I did.

Q. I am referring you to the second section of VD-56. Tell us what that is.

A. The second section of VD-56 contains a title page designated "Miscellaneous Known Samples".

Q. Explain to the judge please what that contains and why you did what you did there?

A. These samples are blood samples from other suspects in the case.

Q. And how many were there? In that particular -- how many did you run in that particular autorad or blot?

A. In this particular gel there were 5 other suspects run.

Q. Did you type the DNA contained in -- extracted from those samples? Did you type them using the RFLP technique?

A. Yes, I did.

Q. What, if any, conclusions and what, if any, comparisons did you make?

A. I compared the DNA profiles found in this particular gel, blot, to the DNA profiles found in the first

membrane and found that the donors of the exhibits in this 'Miscellaneous Known Samples', the donors could not have contributed the DNA found in any of the samples in exhibit 1, the gel #1.

Q. Do you have any other further -- did you do any further work in relation -- any other blots in addition to the four you have testified to that you ran in relation to this case?

A. There were blots of test gels of the gels that I have explained in this particular matter.

Q. I see. And hwen you were running these blots the first, second, third and fourth, you indicated I believe yesterday that you keep notes and polaroids of the steps in the typing process; is that correct?

A. Every step is documented. Some on official forms. Others in handwritten notes and each gel is documented by use of a polaroid.

Q. The typing that you -- you did this for all four blots.

A. Yes, I did.

Q. Are your steps capable of being reviewed by others?

A. Yes, they are.

MR. WALSH: Just a moment, My Lord. I wish to review my notes.

THE COURT: Yes. Are you winding up with this witness?

MR. WALSH: Yes, My Lord. I just want to review my notes.

THE COURT: Well, why don't we do this? It is 22 minutes after 12. Mr.Furlotte won't get very far into this witness. Why don't we recess now? Leave the witness on the stand. It will give you a chance to --

MR. WALSH: Thank you, My Lord, I appreciate that.

THE COURT: I don't want you to get your second wind over the lunch hour.

MR. WALSH: No, no. I stay pretty well to a schedule here.

THE COURT: All right.

(RECESS: 12:20 - 1:45)

THE COURT: Do you have any other questions?

MR. WALSH: Just a couple, My Lord.

Q. Dr. Bowen, there is an order in place dispensing with continuity of exhibits for the purpose of this particular voir dire. However, I would like to refer you to the standards that you have noted -- that you have compared the samples to. First of all, 56A-69A I will show you what has been marked on this hearing earlier as VD-14. Would you look at that for me please and tell me whether you can identify that.

A. Yes, I can. It bears my case file number, the exhibit number, my initials and the date received.

Q. And the item VD-15?

A. Yes. Again it bears my case file number, exhibit number, my initials and the date received.

Q. VD-14 refers to 56A.

A. That is correct.

Q. And VD-15 refers to 69A.

A. Yes, that is correct.

Q. And how do these relate to the standards you have referred to this morning?

A. The hair roots contained within those ointment tins were combined to form what I call exhibit 56A-69A.

Q. I refer you to what has been marked on this hearing VD-20. Look at that for me please. Do you recognize that?

A. Yes. It bears my initials, case number, exhibit number and the date received.

Q. What standards, if any, does that refer to?

A. It refers to standard 83A.

Q. That relates to the same standard that was used on the second blot?

A. Yes.

THE COURT: That was VD --

MR. WALSH: VD-20, My Lord.

THE COURT: -- 20.

Q. And VD-18? Look at that for me please and tell me whether or not you can identify that.

A. Yes. It bears my file number, the exhibit number, my initials and the date received.

Q. That relates to what standard in this particular matter, if any?

A. This is my exhibit 335.

MR. WALSH: My Lord, further to your direction this morning we have had prepared through noon hour the chart marked VD-88. We have a paper representation of that particular chart. Dr. Bowen, you have looked at it and it is accurate.

A. I have looked at it and it is an accurate representation.

MR. WALSH: I would move to have this marked on the hearing, My Lord.

THE COURT: Yes. Is that a duplicate --

MR. WALSH: That is a duplicate of VD-88.

THE COURT: But it doesn't look like it. There is typing on there or something. Oh, sorry. At a distance this seemed to be sort of a narrated thing. I see

what you mean. Yes. You have given a copy to Mr. Furlotte.

MR. WALSH: Yes, I have, My Lord.

THE COURT: We will call that --

MR. WALSH: What you could do, My Lord, if you wish, VD-88 has been marked as an exhibit. One of the things we were going to try to avoid is the Clerk having to have these charts -- take control of these charts. You could, if I may suggest, have that marked as VD-88 and that could constitute the exhibit. We have been doing that for other things throughout this hearing.

THE COURT: Do you have any objection to that?

MR. RYAN: No. I would just point out, My Lord, that the word 'Locus' on the left-hand column above the probes as designated as they run across the top, is not present. The word 'exhibit' which is the top heading for all the items in the far left-hand column is not present. But other than that it appears to be a fair duplication of that chart.

THE COURT: Well,let's give it another number here. There are those two small differences.

MR. WALSH: Yes. 'Locus' and 'exhibit', My Lord.

THE COURT: Let's call this VD-89. In looking at VD-89 though we will assume that the word 'locus' and the word 'exhibit' are in there. You don't have another copy of that now that I could follow along.

MR. WALSH: Yes, I do.

THE COURT: Thank you.

MR. WALSH: Those are the questions for the Crown, My Lord. Thank you.

THE COURT: Thank you very much. Mr. Furlotte?

CROSS EXAMINATION BY MR. FURLOTTE:

Q. Dr. Bowen, were you in court yesterday when Dr. Carmody was testifying?

A. Yes, I was.

Q. Do you recall the exercises I went through with him to see what the probabilities were that anybody else would fit certain matching patterns as somebody else?

A. Yes, I was.

Q. Would you be able to conduct those same experiments?

A. Yes, I could. I could follow the directions that you gave Dr. Carmody, yes.

Q. Okay. Yesterday, because I had two other experiments to run but I was running out of time with Dr. Carmody I would have went over the time limit set by the judge, so maybe I will have you continue those two other ones. Would that be okay?

A. Yes.

Q. I will find the appropriate -- What I want to do is check out the human cell line in lane 20.

THE COURT: This is with respect to the first membrane on VD-54?

A. VD-67.

Q. For probe D2S44. VD-67 is it?

THE COURT: VD-67.

Q. We have a band there marked 3038.

A. At lane 21.

Q. Lane 21.

A. Yes.

Q. And there is also band 2810.

A. That is correct.

Q. Would they fall in the same bin or bin margins? You don't have your sizing sheets there.

A. No, I do not.

Q. 64 I believe were rebin population distribution. Exhibit VD-64.

A. The question is do they fall in the same bin?

Q. Yes.

A. 3038 would fall into bin 13. 2810 would fall into bin 13.

Q. They would both be put into the same bin even though they calculate for different bins in here on your sizing, your database.

A. Yes. What I would do is they fall into separate bins actually. The absolute number obtained for 3038 would fall into bin 14 and the absolute number received for 2810 would fall into bin 12. However, using measurement imprecision, multiplying that by .026 and adding that to those values or subtracting it from those values, one sees that bin 13 is more common than both bin 12 and bin 14. Therefore, with measurement imprecision that value would slide into bin 13 in both cases.

Q. Is that also done when you are constructing your database? They go in separate bins or would you put them in the same bin?

A. No. When you are constructing your database you take the value that you obtain for that particular fragment.

Q. For that particular size.

A. Yes.

Q. So you wouldn't do that in constructing your database.

A. No.

Q. Okay. So I think it would be more appropriate just to use the one, let's say the 3038. Or be hard to say which one. What would 2919 and 2965, where would they fit in? Just on your sheets there. 2919.

A. 2919 would fall -- just using the sheet -- into bin 13.

Q. And 2965?

A. Would again fall into bin 13.

Q. Okay. We will just use bin 13 for the purpose of this experiment. For bin 13 will you calculate the frequency of somebody else falling into bin 13?

A. Of somebody else falling -- the frequency of this -- both bands being in bin 13.

Q. Not both bands. Just the frequency of your top band. The 3038.

A. That would be -- the frequency of bin 13 is .097. The frequency of someone else having that same bin band would be 2p which is .097 times 2. Equal to .194. Do you want the number in terms of 'one in'?

Q. Yes. It would help me out. Probably won't make any difference to you in your final calculations, but just for the record, if you could put that down.

A. Would be one in five.

Q. One in five. Maybe you could mark that for probe D2S44 across here. Okay. We would go to probe D4S139. Look at the fragment length 6149. See which bin that falls into.

A. That would fall within bin 11 without taking measurement imprecision into account.

Q. Before we conduct that would you see if the figure 5961 would also fall in bin 11?

A. 5169?

Q. 5961.

A. 5961. It would also fall into bin 11.

Q. Okay. So would you calculate the frequency then for bin 11?

A. The frequency -- I would like to know what --

Q. The frequency of anybody else --

A. -- of anybody having that particular --

Q. -- band size.

A. -- band size. Fine. Again that would be 2p. The frequency for that bin 11 is .121. Is equal to .242 which is approximately one in four.

Q. Okay. Next probe D17. And the size of the fragment I want you to look fo r is 1762. See which bin that falls in.

A. Without taking measurement imprecision into account that would fall into bin 6.

Q. And I would also like you to take the fragment size /1522. See which bin that falls into.

A. Without taking measurement imprecision into account that falls into bin 5.

Q. Maybe before we go further I will just check this. The band size 1787, does that also fall into the same bin as 1762? I think they were only 25 base pairs apart.

A. 1787. Without taking measurement imprecision into account it would fall into bin 6.

Q. That is the same bin. Okay.

A. Yes.

Q. Also the fragment size 1542, does that fall into the same bin size as 1522?

A. Again without taking measurement imprecision into account it would fall into bin 5.

Q. Now, go to probe D16. Is this the probe where all the ones under 1,000/some fall into the same bin?

A. Yes. The first bin is 0 to 1077 and the fraction is about 50 per cent that falls into that bin.

Q. I guess both bands for the human cell line fall in that same bin do they not?

A. Yes, they do.

Q. Okay. So we will take the frequency for any other person having a band falling in that same bin. What would that frequency be?

A. 2pq. That would be one in 1.9.

Q. Could you do the calculation, the Hardy-Weinberg formula and the product rule, to see what the probability would be for somebody else to share these two bands which fit into the same bins as the human control line?

A. We haven't calculated the frequency for D17 yet. We have just identified the bins.

Q. For D17?

A. Yes. For D17 we are looking at two bands. One in bin 6 and one in bin 5. Frequency would be 2pq. The frequency for an individual to have two band patterns, one in bin 6 and one in bin 5, for D17S79 would be one in 19.

Q. Now, would you continue to use the product rule to see the frequency of all of the combination of all these bands?

A. That would be one in five times one in four times one in nineteen times one in 1.9. Is one in 720.

Q. That would fall in the range of basically your database -- the number in your database. Be within -- you might be able to expect to be able to pick that frequency out within your database.

A. It might be possible, yes.

Q. It is not phenomenal anyway.

A. That people would share these bins?

Q. -- share within a bin that many bands.

A. No.

Q. What I did for the purpose of this, Dr. Bowen, is found it in the autorad of your first gel, any of the people in that autorad, this seemed to be the most frequency level with anybody who was in your database for like HC, your human control. Is that into your database also? That human control line?

A. I do not believe so, no.

Q. You don't believe so.

A. No.

Q. But that person is not from the Newcastle area.

A. Not that I am aware of,no.

Q. The person I compared that with who might share the same amount of bands is Linda Daughney, but I don't imagine you checked for any kind of comparisons of this rate have you?

A. No, I have not.

Q. Picking a person from Newcastle who would share the most amount of bands possible in the first gel with somebody from outside the region, the odds are consistent then with what you would expect?

A. There is no doubt that people will share bands throughout the system. That is exactly why we do this particular exercise in creating databases. To assign a frequency to those bins. Sharing bands -- these are sharing bins now. They are not sharing bands.

Q. Right. No. Sharing bins. I agree. Not sharing bands. But the frequency is calculated on bin sharing and not band sharing. Is that correct?

A. The frequency is performed on bin sharing but the binning is done using measurement imprecision also.

Q. Yes. I realize that. I am just considering the frequencies. That is calculated on bin sharing and not band sharing. You agree with that?

A. Anyone that falls within that bin, yes.

Q. So something like Dr. Carmody's analogy about birthdays. The odds of --

MR. WALSH: Objection. He is roaming now. He is roaming into the population genetic field in the Crown's humble opinion.

MR. FURLOTTE: He uses frequencies and the statistics. I am not asking him to form any great opinion. Dr. Carmody explained it yesterday. I just want to see if it fits in with Dr. Carmody's analogy.

THE COURT: Well, if this doesn't come within your expertise, Doctor, you let us know.

A. Yes, My Lord.

THE COURT: I will give Mr. Furlotte fairly wide freedom here but --

Q. As I understand Dr. Carmody's analogy with birthdays, it is one in 65 (sic) that somebody else out there is going to share his birthday. Is that the way --

A. I believe he said one in 365.

Q. Sorry. One in 365.

A. Yes.

Q. Maybe the analogy doesn't fit. I don't believe it does so I won't put it to you. Dr. Bowen, you testified that you belong to the technical working group?

A. That is correct.

Q. And the standards set for the technical working group I believe were completed on August 13, 1990?

A. Standards?

Q. I have here the "Statement of the Working Group on Statistical Standards for DNA Analysis". It is in evidence as one of the exhibits.

A. Oh. I believe you are referring to the statement of the workshop on statistical standards in DNA analysis?

Q. Yes.

A. That is not TWGDAM.

Q. What?

A. That is not a TWGDAM group.

Q. Sorry. I am going to have to move closer. Mr. Walsh is right. You don't speak very loud.

A. That is not part of the technical working group on DNA analysis.

Q. You belong to that group also.

A. I did, yes.

Q. That was completed August 13, 1990, this statement?

A. I believe the statement was completed in June or July 1990. That is when it was published.

Q. Were those standards in force whenever you were

conducting these tests in the Legere case?

A. Yes, they were.

Q. You had quality assurance programs into effect when you were conducting the tests for the Legere case?

A. Yes, we did.

Q. In '89?

A. Yes, we did.

Q. It states here on page 2 that: "The quality assurance programs must be in general agreement with published minimum guidelines established by the forensic science community."

A. That is correct.

Q. And those minimum guidelines were followed also I assume.

A. That is correct.

Q. And under the heading on page 2 of "Subpopulations and Their Significance to Current DNA Analysis", it states in the middle of paragraph 3, it says: "The populations being studied are representative of all major racial groups and include several very small isolated groups."

MR. WALSH: What document is this? If I could just clarify as to the document so I can find it. Perhaps we could refer to it by exhibit number.

MR. FURLOTTE: Exhibit VD-87. Page 2. Middle of paragraph 3.

Q. It says: "The populations being studied are representative of all major racial groups and include several very small isolated groups." Do you have that?

A. Yes, I do.

Q. Do you know whether or not the R.C.M.P. lab is conducting these several studies on several very small isolated groups?

A. This does not refer to each individual forensic laboratory performing these studies. These are done in collaboration with various population geneticists throughout the United States and Canada. The R.C.M.P. is studying several isolated populations. Particularly the aboriginal populations in Canada.

Q. Are there any studies being conducted that you know of in the Caucasian small isolated groups?

A. Not in Canada that I am aware of at this stage, no.

Q. What about in United States?

A. I can't speak for all the forensic laboratories in the United States. I know every forensic laboratory implementing these technologies are looking into the individual populations. I cannot ascertain at this stage whether or not they are all isolated communities or not.

Q. One of your statement is that -- in paragraph 4 states: "Significant differences in allele frequency estimates can be expected between major population groups such as Caucasians and Blacks, but the differences within populations often will not be statistically significant." Is that correct?

A. That is correct.

Q. As a member of that group, the difference between the Caucasians and the Blacks, was it considered at that time that if the same significant difference was found within the population in the Caucasions or the Blacks, that that would be statistically significant?

A. I think Dr. Carmody addressed this point yesterday when saying there is sometimes statistically significant bin frequencies differences between Caucasian populations as opposed to different racial groups. One can see that doing the forensic analysis using a product rule across several loci that the difference between the databases may not be in fact statistically significant.

Q. Dr. Carmody is not a member of this group is he?

A. Dr. Carmody, no, was not involved.

Q. But you were involved back in 1990.

A. Yes, I was.

Q. Do you know what the opinion was back in 1990 if you found those same differences within a population?

A. I think this paragraph addresses that in the sense that it says: "However,minor differences will always occur when sample sizes are small." One is looking at -- this part of the statement was actually written by Dr. Ken Kidd. Now, his opinion was that one can in certain circumstances arrive at statistically significant differences between populations.

Q. Right.

A. Between populations such as different racial groups. Caucasians versus Blacks.

Q. Right. And those studies have been conducted and we know the degree of differences which are significant and it was known at the time was it not?

A. Yes, it was.

Q. To your knowledge have we not now found that same degree of differences within Caucasians and within Blacks and within Indians?

A. We have not found it in the Canadian Caucasian population, no.

Q. You haven't looked for it.

A. Of course we have. I think Dr. Carmody addressed this point several times during his testimony.

Q. That satisfies you also as a member of this group.

A. Yes.

Q. Dr. Carmody's explanation satisfies you as a member of this group that that criteria has been met.

A. For the Canadian Caucasian populations, yes.

Q. On page 3 of that statement at the top which says under the heading "Use of the Product Rule and the Significance of Hardy-Weinberg Equilibrium", the statement says: "To estimate the population frequency of a particular genotype, it is convenient to assume that genotype and gene frequencies are related by the Hardy-Weinberg rule." Is that because there is no proof that you are assuming and it is convenient to assume?

A. At the time this document was written several studies were being performed by Dr. Kidd and Dr. Weir on the issues addressed yesterday, the use of the Hardy-Weinberg Equilibrium and the product rule, specifically looking at linkage equilibrium. The data Dr. Weir had using his bootstrap method of statistical analysis has indicated to him that there is no correlation between alleles at a loci and no correlation between alleles between loci and from that it was deemed appropriate to use the assumption of Hardy-Weinberg equilibrium and the product rule.

Q. I am not asking you, Doctor, to repeat all of the

opinions that Dr. Carmody gave yesterday.

MR. WALSH: Well, that --

Q. I am asking you if --

MR. WALSH: Objection. That might not be what he wants but that is the way that the witness is formulating his answers and that is in fact what Mr. Furlotte is getting into. The population genetics end. The Doctor has a right to refer to others in the field to provide an answer to Mr. Furlotte.

THE COURT: Well, you are asking for his opinion and he is giving it.

Q. Are you basing that opinion just on Dr. Carmody's testimony yesterday?

A. No, I am not. I have had our data studied by other individuals such as Dr. Weir and Dr. Kidd and we have actually brought this data to Dr. Carmody for his interpretation too.

Q. To follow from that statement where "it is convenient to assume that genotype...", in paragraph 2 on page 3, the last sentence, it says: "Hence, it is necessary to test for consistency with Hardy-Weinberg expectations in the appropriate databases, but not necessary to demonstrate that the assumptions which would lead to these frequencies are true." Why does the group feel it is not necessary to demonstrate that the assumptions are true?

A. Dr. Kidd feels that populations can be within Hardy-Weinberg equilibrium without meeting all the assumptions that have been stated for Hardy-Weinberg equilibrium. That is, a population of infinite size. No population meets that criteria. Populations at

random mating. That is fairly critical. The absence of ethnicity, geographic isolation. These are the assumptions that he is talking about. That they do not have to all be met in order for the population to be within Hardy-Weinberg equilibrium.

Q. Page 4, paragraph 6, it says: "If frequencies at different loci are independent, then identity probabilities may be combined over loci by multiplying the single-locus probabilities." Now, as I understand that paragraph to read, it says, if and only if, the frequencies at different loci are independent, then you can use the product rule. If they are not independent at different loci then you cannot use the product rule. Isn't that what the statements of the group says?

A. Then if they are shown to be dependent that one cannot use the product rule.

Q. If they are shown to be dependent you cannot use the product rule.

A. That is correct.

Q. As far as you know the studies of the Canadian Indians are not independent among Canadian Indians are they?

A. There is no indication that they are not independent.

Q. There is no indication that they are not independent?

A. That is correct.

Q. From one group to another?

A. That there is -- we are talking about --

Q. If there is a significant difference does that not show that they are not independent?

A. There is significant differences in the bin frequencies

That has no indication that there is a dependence of one locus to another. There is no indication of linkage equilibrium.

Q. What is linkage equilibrium?

A. Linkage equilibrium is where two loci, say D1S7 and D2S44, are actually linked. That if one obtains a pattern,two alleles with one locus, then one would expect to see a set of loci that are on a set of alleles on the second locus, that are sort of tag-teamed along with that. They are linked.

Q. What do you do? Draw a graph to show the / curvature for each loci --

A. No, no.

Q. -- with your bins or --

A. No. One would see that if one had two alleles at a given locus one could predict the alleles that that individual would have at a second locus because they are not random.

Q. You mean the same band size?

A. No. They would be different band size but one could predict the allele sizes that one would see at that second locus because they are linked. If one has a totally random system and they are independent one could have a band size in one locus that would have no relation to the band size one got in another locus.

Q. I guess that is where you lose me or you haven't been able to explain it to me. I can't understand it anyway so maybe we could try again.

A. For linkage equilibrium one has to show that there is a correlation between the fragment sizes one achieves with one locus and the fragments from

another. They are not independent of each other.

Q. How do you show that?

A. How do you show that?

Q. Yes.

A. Well, one could do it by looking at the database to see if there is linkage.

Q. What would the database tell you -- how would the database tell you that there is linkage?

A. One would look at the expected versus the observed frequencies one obtains. The expected versus the observed band sizes, and in order to do that rigorously, as Dr. Carmody said, one would need a database of 50,000 to 100,000 individuals so there are statistical means of doing this that I am not capable of performing, that we rely on population geneticists and statistics to look at this by other methodologies.

Q. What does paragraph 6 mean when it says that: "The product rule, when appropriate, may be applied to estimated genotypic frequencies at each locus (if Hardy-Weinberg can be assumed) --" -- which you people are assuming; is that right?

A. We have deemed it appropriate to assume that, yes.

Q. Convenient to say the least. Then it continues on and it says: "-- or to bounds on these frequencies (if Hardy-Weinberg cannot be assumed)." How do you determine what bounds to put on it?

A. I can't answer that question.

Q. You are not qualified to answer that.

A. No, I am not.

Q. Do you know whether or not that is one of the reasons

why some scientists would like to have the upper confidence -- like, Dr. Carmody with his 99 per cent upper confidence level? Is that possibly one reason why he has taken that in?

A. It may be, but I think Dr. Carmody mentioned there are ways of compensating for populations to be out of Hardy-Weinberg equilibrium, and I don't know how to do that. These bounds may refer to confidence limits that can be used as Dr. Carmody has used htem

Q. On page 4, paragraph 2 starts on page 4 and continues on page 5 under the heading "The Use of "Matching" Criteria and Interpretation of RFLP Analysis Results in Forensic Casework", and discussing the term 'match' states: "For forensic purposes a "match" between two patterns means that the patterns are consistent with having been produced by DNAs from the same individual or, alternatively, that on the basis of the observed patterns, it is not possible to exclude the DNAs as having come from the same individual. In this document, "match" is intended to have this meaning." Is that correct?

A. That is correct.

Q. When you describe a match either after the running of one probe orthe running of five probes, all you can say according to this is that "on the basis of the the observed patterns, it is not possible to exclude the DNAs as having come from the same individual. In this document, "match" is intended to have this meaning."

A. That is referring to the match itself and not attaching any statistical significance to it.

Q. It doesn't say here that it would be extremely rare for it to be somebody else. It just says it can't be excluded.

A. That is the way it is expressed here, yes.

Q. It says again at the bottom of page 5, paragraph 3, it says: "Questions regarding "knowledge of the properties and limitations of the specific techniques used" include: Is there evidence for -- and can account be taken of -- incomplete digestion, degradation of the sample DNA, band shift or imperfect transfers..." Would you describe what band shifting is?

A. Band shifting is where one has -- essentially a band shift is a lane shift. Where there is a contaminant or some component in that DNA sample that you are examining that causes the entire lane to run either faster or slower than it really should. This is generally a visual thing. One can detect band shifting when comparing two samples or known source and they do not match because it has shifted out of the visual match.

Q. How do you detect band shifting when you are running a sample from a known and an unknown source or two unknown sources?

A. In our system we use the monomorphic probe to detect a band shift in a lane.

Q. How does the monomorphic probe tell you whether or not there is a band shift?

A. The monomorphic probe gives us a value of molecular weight fragment of 2731 base pairs. If that is substantially different from the adjacent lanes or any lanes within the gel outside of measurement

imprecision then one would determine it to be a band shift and it would be called inconclusive.

Q. What do you call substantially different?

A. Outside the match window.

Q. Would have to be a band shift in the monomorphic probe which exceeds 5.2 per cent before you call it a band shift.

A. That would indicate that there is an error in that particular lane and it should not be called.

Q. So it too has to exceed the match window to declare a band shift in the monomorphic probe.

A. That is -- it would have to be outside the match window to declare a band shift, yes.

Q. And if it is not outside the match window then it is just measurement inaccuracies or imprecision or how do you call it?

A. There is a certain measurement imprecision with that particular fragment size. We have seen it in our database and is partly how we established our measurement imprecision window. By looking across our database we detected that this band, this fragment, could vary by as much as 5.5 per cent across a population of 600 individuals. 99 per cent of those values were within 5.2 per cent and that is what we determined at that point to be our match window.

Q. This is being run on pristine samples.

A. This is being run on pristine samples. Further to that we have looked at forensic samples, over 500 comparisons, and found that 99 per cent of our forensic comparisons are within 5.2 per cent, confirming the

use of the match window. It is an empirical observation that we have samples that sometimes exceed the match window but to be conservative we have chosen 99 per cent of our matches fall within 5.2 per cent and that is what we use as our match window.

Q. Okay. Could the measurement imprecision of 5.2 or 5.5 per cent plus band shifting tend to cancel each other out where all of a sudden it looks like, hey, we got a perfect run here? How would you -- how could you test for that? Do you know what I mean?

A. Can the two cancel each other? The measurement imprecision would be something that one would see within the gel. If one is looking at a gel and you find a monomorph, in the absence of band shift, will be consistently high or consistently low or consistently being on the value. If one is looking at the difference between lanes within that gel, if there is a substantial difference between lanes, between adjacent lanes or lanes on a very sensitive gel, then one would conceive that a band shift was there. This would fall generally within the -- I am talking the match window in this extent between gel to gel comparisons now. If there is a substantial difference between lanes on a gel that is exhibited by the monomorph one could determine a band shift, but I don't think they could cancel each other. Not in my experience.

Q. Well, I will give you an example. If you had a contaminated sample such as from your experience with the ethidium bromide that was contaminated and they

run slow I assume if they are contaminated.

A. They can.

Q. Because of the extra weight that is on -- size-wise and they run slow through the gel.

A. The rigidity.

Q. And you have had some of them which I guess shifted by as much as six per cent.

A. That is correct.

Q. And you admit that you can have what you call band shifting or fast lanes which can be measurement imprecision out by six per cent. I am just saying, if you had a contaminated sample that was slowed down by six per cent and you happened to have a fast lane that would normally be up by six per cent, you would have a true reading on your monomorphic probe showing this thing to run perfectly.

A. No, because what you are looking at is a shift in one particular lane. Now, we are looking at the monomorph across the gel in how it ran across the gel. It should run consistently. If there is a major change in that particular lane and it cancels everything out, it will run, bang, on the monomorph, but if there is a shift in that particular gel one would see that the other monomorphs did not match. There would be a difference.

Q. When you see a difference on your monomorphic probe -- say some are out by one per cent, +1%, and others are out by +3 or 4% in the different lanes, that differences between them, is that attributed to measurement imprecision or could that be attributed to some kind of contamination or degradation?

A. I haven't seen that in this particular case. In fact I have never seen it in case work. But if that were the case one would probably attribute that difference to a contamination or a band shift. That great a difference. You are looking at greater than two per cent difference between the monomorph in one lane and another lane.

Q. You mentioned when you were testifying that you have consulted with defence attorneys especially for the use of PCR?

A. That is correct.

Q. After you consulted with the crown's expert witnesses you have come to the conclusion that the results of the test should be toned down. That is not the words you used, but something to that effect.

A. The results of the test as reported to court were different. They were less probative.

Q. Less probative. So a lot has to do with the interpretation of test results as to the value that is put on it and who is doing the interpretation.

A. That particular case, again I should emphasize, involved the polymerase chain reaction which is not a technology that we use currently for forensic purposes in the R.C.M.P. It is a technology that we are developing and feel that until it is fully developed it is unreliable in certain circumstances.

Q. But you were able to convince the crown's expert witnesses of that.

A. Yes.

Q. The crown's expert witnesses were I assume ready to go to court and say that 'we got it'.

A. That is correct. In fact on the preliminary hearing he did.

Q. It is a matter of the individual interpretation of autorads and the technique that they are using.

A. There is no autorads used on this particular technology.

Q. Okay. In PCR there is no autorads?

A. No. This was the DQ alpha test.

Q. Okay. I don't understand anything about PCR and very little about RFLPs so -- But you would have to admit, Doctor, that the interpretations of the tests and the implications of those tests, a lot of it is very subjective.

A. In this particular type of test, the DQ alpha test, the way this test was done it was very subjective. Could not be confirmed by a second independent analyst.

Q. You had been working on other cases while you took on the Legere file.

A. That is correct.

Q. Seven, eight hundred cases?

A. In that area.

Q. You hadn't finished any of them and you took on the Legere file.

A. No, I had not.

Q. I am curious, Doctor, that you would run all these probes, D2S44, D1S7, D4, D17, D16. You had run all these probes in 1989. Is that right?

A. That is correct.

Q. And one year later decided to run D7 and DYZ1 and -- when did you run D10?

A. November 1st 1990.

Q. It is almost one year later since you last tested.

D16S85, when was that run? December 5th was it? Have a look in your notes.

A. D16. Run December 5th 1989.

Q. December 5th 1989. You gave a preliminary report November 1st 1989.

A. November 10th 1989. Is that the one you are referring to? November 10th.

Q. I thought mine said November 1st. November 10th 1989 you gave a preliminary report.

A. Yes.

Q. Will you read the last paragraph of your preliminary report?

A. "It should be fully realized these are preliminary results and under normal circumstances profiles from at least three different DNA probes would be used to establish identity. The results of further tests will be forwarded to your office as they become known."

Q. That was as a result of doing one probing was it? D2S44.

A. That is correct.

Q. December 10th you wrote -- November 10th you wrote the preliminary report and you conducted tests up to December 5th. Why did you wait almost one year to continue testing?

A. After December 5th I believe I was involved in several other cases where court was involved. They had to be completed in order to meet court dates. As of mid January I went to a TWGDAM meeting for over a week. When I got back in February we had closed the lab and begun renovations to expand the lab. I worked

on a very small lab, a different facility, for a short time working on other cases that had diary dates for court. After three months we officially opened the lab again on May 14th 1990. At that same time we began our training program for the various individuals in the Ottawa laboratory and being in charge of training I was heavily involved in training and therefore not doing much case work at the time. After that I received several more exhibits I believe in the summer of 1990 which I started to analyze and finally found time to complete the case in the fall of 1990.

Q. You will notice for -- maybe this is just a coincidence and there is no degree of probability we can draw to this, but after you run the D16S85 probe where everything was inconclusive, you shut it down. Have anything to do with it?

A. Just a coincidence.

Q. Did this test result have anything to do with it?

A. Just a coincidence.

Q. Just a coincidence.

A. I would have reported the results after the first four probings if I had done the control probes. I cannot report results until -- a final report until I have done the D7Z2 and DYZ1.

Q. Once you start the test usually the same operator continues through with them. They don't let somebody else run new gels on it.

A. No. It is our -- so far been our policy that one individual carries the case from beginning to end.

Q. Did you run any other probes which isn't shown here?

A. No, I did not on this case, no.

Q. There was no probe that was run after D16S85 that would exclude Mr. Legere?

A. No, there was not. In fact D10S28 was added -- I am not sure exactly when we started using D10S28 but it was in the fall of 1990 was when we first started it because it is a very sensitive probe and we had just completed the database at that time.

Q. Were you having problems with your nylon membranes also at this time when you run these probes?

A. Yes, we were encountering some inconsistencies in the nylon membranes at that time.

Q. Causing you problems in interpretation.

A. No. They were causing problems in transfer of the DNA to the membrane.

Q. And sometimes when -- it is possible when you transfer to a nylon membrane it is also possible for fragments to get shifted, is it not? -- position?

A. No. They are not shifted out of position. The bands become incomplete or they are not there. They don't transfer.

Q. Could that be possibly some reason for the very light bands on these autorads?

A. No, it is not. The reason for the very faint bands in this particular autorad is the fact that there was very little DNA to begin with. It is still our -- almost our sensitivity limits.

Q. When you run your test gel for the -- to see if there is proper digestion and there is -- your analytical gel to see if -- for quantity, there was no problem with those gels. They are very easy to

interpret or could there be problems like some of the slides that you were showing?

A. In terms of the amount of DNA visible on those test gels?

Q. Yes.

A. With some of these samples it is very, very faint and very difficult to see anything, because we are dealing with very small amounts of DNA.

Q. What about for digestion? That maybe be a little problem in interpreting digestion on it also or were those very clear?

A. Again there was no indication that these things had not digested but again they are very faint.

Q. They are very faint.

A. That is correct.

Q. Could be mistaken digestion also?

A. If there is a mistake in digestion it will show on your analytical gel and on your blots. You will have a partial digest or the sample would not have digested at all.

Q. Okay. But I am talking about the analytical gel and the blot, whatever test you use, to look at that and interpret that to see if there is proper digestion. That is a very clear test. It is not ambiguous.

A. Which test are you talking about now? Are you talking about the test gel to see if there is any problem with digestion?

Q. Yes.

A. Okay. The test gel to see if there is any problem with digestion in this case -- again as I have

mentioned we are dealing with very small amounts of DNA. It was very difficult to see if the samples had actually digested totally because I could not see any indication that they had not digested properly. Now, with the blot itself, would indicate whether there was a problem with digestion, because if there was incomplete digestion one would end up with a partial digest. A series of bands/one that could not attribute to an individual but would look like a partial digest. That is diagnostic of a partial digest. The allelic controls themselves digested properly so there is no indication that the reaction at that time did not work.

Q. But you couldn't be certain that it did. There is no indication that it didn't work but there is no absolute indication that it did.

A. The final product itself is an absolute --

Q. The final product itself is the --

A. -- is the definitive way of telling whether it worked or not.

Q. Sometimes if there is not proper digestion I understand the final product you may get multiple bands in some lanes also.

A. You will get a partial digest which is a series of bands larger than the molecular weight one would expect for those fragments. It is a diagnostic series of bands that one can see.

Q. But if you get a series of bands smaller than the ones you would expect?

A. That would be more indicative of degradation.

Q. That would be more indicative of degradation.

A. Yes.

Q. If you had that would it be proper to interpret the -- any match or exclusion or would it be inconclusive?

A. No, there is often degradation found in forensic samples. It often is seen as a smear. Sometimes you see a background smear in some of the blots that I show. That makes it more difficult to interpret the bands but they are still interpretable.

Q. I heard you mention when you were talking about the probes/different sensitivities of the different probes, and there is no particular order to run your probes in although some are more sensitive than others.

A. That is correct. One doesn't have to run these in any particular order. There is some order that is preferable to run these. Normally in our system we start with D2S44 because it is a very -- it is a sensitive probe. It is of medium sensitivity but it is also very discriminating so one can see whether there is going to be an exclusion or inclusion fairly quickly. The next series of probes, D16, D17, are probably the best probes to use because they are the least sensitive. Then one follows with D1 or D4 because they are more sensitive and they are more difficult to strip off. The final probes one has to use, of course, as I mentioned previously, is D7Z2 and DYZ1 because they are very difficult to remove from the membrane.

Q. D1 and D4 are probably your least sensitive?

A. No, they are more sensitive.

Q. They are more sensitive. So if you got anything you should be picking it up with your D1 and your D4

rather than say picking it up with your D10 or --

A. D10 is -- I haven't really got a good feel for the sensitivity of D10 because it is a probe I have only been using for the past six months in case work, but it appears to somewhere in between the sensitivity of D1 and D4.

Q. Are there any validation studies on the sensitivity done on these probes or is this just through experience?

A. Through empirical observation.

Q. Just empirical observation. Has anybody done any studies or experiments with it to try and rate the degree of sensitivity of these probes and put them in some kind of orderly fashion?

A. No. Not that I am aware of.

Q. I believe you mentioned these probes are more sensitive than --

A. -- than the polymorphic probes.

Q. -- than the polymorphic --

A. Yes. In the case of D7Z2 there is hundreds of copies of that particular repeat and in the DYZ1 there are thousands of copies of that particular repeat as opposed to smaller numbers in the polymorphic probes.

Q. That means you get more probes sticking to the one fragment.

A. Precisely.

Q. And that is why it shows up more.

A. Precisely.

Q. In lane 3 of the sample of Mr. Legere's hair you had combined, what was the quantitation you had of that that you started off with?

A. It would have been of the order of 30 nanograms.

Q. Okay. Probably I have a stupid question for you but I assume when you run this down there is -- a probe is going to stick/that fragment of each cell. Your to DlS7. So for each cell that has this chromosome, Dl, you are going to have one probe stick to one cell. This section of one cell.

A. It is not necessarily in that ratio. You can have several probe molecules binding to an individual fragment. I don't think one can -- that is a rather simplistic way of looking at it but in relative amounts for -- a cell produces one fragment and a certain number of probe molecules bind to that particular fragment.

Q. Okay. What I understood -- the base pairs, when the were severed -- what you call severance across this way in the -- split up and down -- when you cut your base pairs and then your probe sticks to the cut fragment --

A. When you separate the strands you mean. Here.

Q. Yes.

A. In VD-29. Yes.

Q. Then the probe would also have little strands on it and they would hook up -- supposed to hook up to each base pair?

A. They bind by complimentary base pairing, yes.

Q. What you are saying is that more than one probe can hook onto the complimentary base pair? Is that what I understand you to say?

A. No. We are talking about tandem repeats, VNTRs, where the same sequence is repeated several times

at that particular locus. That is the type of analysis that we are doing. VNTS. Variable number of tandem repeats. I am not sure if Dr. Waye mentioned this because I missed part of his testimony, but we are looking at tandem repeats of a certain core sequence. Now, the probe itself recognizes that core sequence. Therefore, if it is smaller than the entire length of the core sequence it can bind to one section of the core sequence. Another probe molecule can bind at a later point.

Q. You might have five or ten probes running along the strand.

A. Five or ten pieces of probe attaching to the same fragment.

Q. But there would be -- in your band there would be many fragment lengths in there. The fragment isn't there and there. They are all just grouped in that area; is that right?

A. There are many fragments of DNA of the same size that have migrated to that particular position on the gel, yes.

Q. And approximately how many should be migrating for the amount of DNA you have in lane 3 say?

A. I can't really estimate that. There would be thousands of them. At minimum. We are looking at a lot of DNA.

Q. On membrane 1189-6 -- is that the number we have on this?

A. Yes. We have referred to it as membrane #1.

Q. Membrane #1. Okay. Membrane #2, that has the other five suspects on it.

A. No. Membrane #2 that we have referred to here has two additional standards reportedly from Mr. Legere.

Q. Okay. The one with the five suspects on it, is that also considered membrane #1?

A. No. That is I think referred to as 4, the miscellaneous standards.

MR. WALSH: I believe it is VD-56, the second section, if I am not mistaken.

A. Yes.

Q. Okay. Now, all of those suspects could be excluded from these samples -- from these exhibits.

A. That is correct.

Q. Every one could be excluded. Now, when you run the probe for the test gel with the hair sample designated exhibit 16 which the hair come off the priest's leg, which was excluded from Mr. Legere. Do you recall what I am talking about?

A. Yes.

Q. Was that checked with any of the other suspects? Was that profile checked against profiles of any other suspects?

A. Yes.

Q. Was there any match there?

A. No, there was no match.

Q. Did you receive any further DNA from other suspects to be checked against the hair from Father Smith?

A. No, I did not.

Q. Those are the complete test results you have done in this case.

A. On Father Smith, yes.

Q. On Father Smith and on the Daughney's and on Flam.

A. Oh, yes. That is the complete set of suspects I have had for these cases, yes.

MR. FURLOTTE: Might we have a break, My Lord.

THE COURT: Sure. Fifteen minutes.

(RECESS: 3:25 - 3:45)

Q. Dr. Bowen, if I recollect from the protocol in 1989 and in '90, there is nothing in the protocol which sets any standards on the interpretation of these autorads is there?

A. That is correct.

Q. And there is nothing in the protocol about the match window is there?

A. That is correct.

Q. So basically under your protocol a match is whatever you want it to be.

A. No, that is not correct. A match is essentially what we declare a match as today. It was just not written into the protocol manual. The protocols were the lab protocols in terms of performing the technique as described in those charts VD-30 and VD-40. It did not include the interpretation of any matches.

Q. Doesn't address band shifting.

A. No, it does not.

Q. It doesn't address degraded samples, degraded DNA.

A. That is correct.

Q. Doesn't address contaminated DNA.

A. No, it does not.

Q. Doesn't address band shifting.

A. Not in that manual it does not, no.

Q. There is nothing mentioned there about monomorphic probes.

A. I believe the monomorphic probe is mentioned in that protocol.

Q. Or does it just list the probes you used.

A. That is where it is mentioned.

Q. Just mentioned as one of the probes that is used.

A. That is correct.

Q. But it doesn't mention anything about what kind of interpretation that would or should come out of the use of the D7Z2.

A. No. That is not mentioned in that protocol for the actual application of the technique. Does not have any interpretation involved in that protocol.

Q. There is nothing mentioned in the protocol as to how your interpretation would be verified or questioned.

A. That is in the quality assurance manual.

Q. That is in the quality assurance manual. Did you say before you interpreted these results,that you had somebody else check it out and give their interpretation?

A. Someone interpreted it after I had given my interpretation.

Q. After you made your interpretation and after you made your report?

A. No. The second individual interpreted it after I interpreted it and before I issued the report.

Q. And who was that individual?

A. The individual was Dr. Ron Fourney.

Q. Did anybody else attempt to interpret it?

A. Dr. John Waye had interpreted it or at least part of

the case prior to my submitting a report, but he had not seen the complete analysis at that time.

Q. Was there anybody who disagreed with your interpretation?

A. No, there was not.

Q. Did Dr. Fourney interpret the results just after you conducted the D16S85 probe or was it after everything was done in December of 1990?

A. He interpreted the results in December of 1990.

Q. And the same for Dr. Waye?

A. Dr. Waye had seen some of the results prior to that. We had not issued an interpretation or a result based on that, but he has since then completed his interpretation of the --

Q. Since then. But how soon did Dr. Waye look at the results of your tests on any of these probes?

A. I can't truly recollect but it was sometime I believe in December or January. December '89 or January '90.

Q. Was there any discussion between the two of you about setting the testing aside until a future date?

A. No, there was no discussion of any sort like that.

Q. That was strictly your decision.

A. That was strictly a decision that was in part forced upon me by the closing of the lab and my other duties and the fact that I had other case work that had to be processed for court purposes.

Q. Once you received these exhibits to run tests and to extract the DNA, what was the first thing you did with them? The different vaginal swabs and body swabs?

A. What was the first thing I did with them?

Q. Yes.

A. After identifying them and making notes on the exhibits themselves?

Q. Yes.

A. I made the extraction of the various exhibits. Extracted the DNA from those exhibits.

Q. You didn't do anything to them before that. Treat them with anything or give them to anybody else to test or -- they were always --

A. No, I did not give them to anyone else to test, no. They had been tested in the Sackville laboratory to the best of my knowledge.

Q. But you didn't conduct any test yourself on them.

A. No, I did not.

Q. --other than extract the DNA.

A. That is correct.

Q. So when you extracted the DNA from the vaginal swabs or the body swabs you don't know if there was any semen on those swabs?

A. I have no personal knowledge that there was semen on those swabs.

Q. I notice in direct examination you said the body swab was semen stained but you are just guessing at that aren't you?

A. No. That was reported to me.

Q. That was reported to you that there was semen stain in the particular swabs they sent you?

A. Yes.

Q. Let's say, for instance, if it wasn't a semen stain, what other stain could it possibly be on the body that would pick up DNA?

A. That would react in that manner?

Q. Yes.

A. I am not aware of any other material that would react in quite that manner because, as I said, we did a differential extraction. Oftentimes vaginal epithelial cells will carry over into the male fraction but if this was not semen there should have been some evidence of that male DNA in the female fraction in all cases, because the purpose of the differential extraction is to take advantage of the very robustness or hardiness of the semen. The spermatozoa are very difficult to break open because they are highly cross linked and one has to add a certain chemical reagents in order to crack that cell open in order to release the DNA, and I am not aware of any other cell type that would react quite in that manner.

Q. If that is what in fact happened.

A. Well, empirically it did happen.

Q. In your notes of November 10th, your preliminary report, you stated that -- from memory you said you would need at least three probes before you could make a positive identification. Do you recall that?

A. I believe -- under normal circumstances profiles from at least three different DNA probes would be used to establish identity.

Q. When you say 'at least' you mean minimum I would assume.

A. In order to come to a number that one would feel comfortable with identifying an individual.

Q. And what number would you feel comfortable with?

A. Well, as I have stated in this particular case, to me a number like one in 68 or one in 7,400 merely means

that it is consistent with having come from the same individual, whereas a number like one in 5.2 million means to me that it is a very rare event and that the possibility that that sample came from someone else is remote.

Q. Okay. If you have a match of three probes, what number would you normally expect from matching up three probes?

A. I don't expect any particular number because with different databases one can achieve different numbers.

Q. I agree. There would be a range there. You might expect one in a couple of hundred thousand to one in a couple million over three probes depending on the frequencies.

A. That is correct.

Q. Well, when you were saying that there would have to be at least three probes you must have been considering a minimum number.

A. This minimum number is to establish a forensic probative value for that match. As I said, one expects individuals to share band patterns. That if one is only able to achieve one or two probings I would not go to court and say, to the best of my knowledge that DNA could not have come from someone else. What I am trying to establish here that with three probings or four probings I become more convinced that the possibility that that DNA came from someone else is remote.

Q. But you are only convinced because the numbers have jumped up into some high level.

A. That is a consequence of adding more probes, yes.

Q. I mean you could have ten probes that match and if your numbers was only one in 5,000 or one in 10,000 it wouldn't be a very good match. Wouldn't be sufficient to go to court with would it?

A. The possibility of that occurring with ten probes is --

Q. That is not the --

A. -- unbelievably low.

Q. But that is not the issue. You must have had a number in mind when you said you have to have at least a minimum of -- or at least three probes.

A. I had no number in mind at that time. I am sorry. I beg to differ.

Q. Dr. Carmody testified that in his opinion -- and it is all subjective. You are entitled to yours too as maybe each member of the jury would be. He figured his would be one in 10,000 would be enough to convince him. What number would convince you?

A. I have never really thought of it in those terms. In the order of one in 10,000 is a reasonable number to me.

Q. So you too agree with Dr. Carmody that one in 10,000 would be enough to go to court and say that this is rare or a very rare occurrence.

A. I would say --

Q. Proof beyond a reasonable doubt is basically what we are looking at.

A. I wouldn't say that with one in 10,000 personally. If I am going to say beyond a reasonable doubt I would say one in 100,000 or one in a million. In that

range. I prefer to be a little more conservative in that respect.

THE COURT: I just would like to say now that I think it would be wrong before a jury to try to quantify a fraction in terms of reasonable doubt.

MR. FURLOTTE: But nevertheless that is what they would do. Human nature --

THE COURT: I am talking about what counsel on one side or the other should be suggesting to juries. That should be avoided. I mean if the occasion arises.

MR. FURLOTTE: It is just a matter when you are comparing it with eye witnesses. An eye witness would say 'there is not a doubt in my mind that that is the person I saw' and then the figures would have the same effect.

THE COURT: I don't -- as a matter of fact, any one of these comparisons -- I think all of these witnesses would say that it doesn't remove a doubt. There can always exist a doubt in a comparison of this nature in a typing. I mean that is why we are talking about percentages. There is never an absolute proof. It is just the same as fingerprinting proofs. There is never an absolute proof. It is just a factor to be taken into consideration. There is still the argument of reasonable doubt and there always will be. But I am saying that one can't say, you know, one over a hundred or one over a million amounts to reasonable doubt and anything over a hundred million there is no reasonable doubt-- there is no room for a reasonable doubt, and anything under that is reasonable doubt.

MR. FURLOTTE: There is no way anybody could resolve this argument. It is just a matter of what kind of prejudicial affect numbers might have.

THE COURT: -- to a jury.

MR. FURLOTTE: Because everybody has their own ideas.

THE COURT: Well --

Q. I believe it was stated that -- after I made a comment,that one of these probes was not used by the F.B.I. any longer -- was it D4S139?

A. That is correct.

Q. Check with the F.B.I. They still use it?

A. Yes.

Q. Does the F.B.I. still use all these probes?

A. No. I am not sure if they ever used all those probes.

Q. Do you know whether or not they have discontinued using any one of these probes lately? In the past year or two.

A. On my last discussion with Dr. Budowle they were considering discontinuing the use of D16S85.

Q. This one here.

A. Yes. Due to its lack of sensitivity.

Q. Lack of sensitivity or maybe because it was showing up too many bands?

A. It doesn't show up too many bands. It is our least sensitive probe.

Q. You mentioned in direct examination that due to a partial digestion sometimes you could have -- that would be one of the criteria which you might use for drawing inconclusive results.

A. That is correct. One cannot make any conclusion on that result.

Q. Are you aware of whether or not concentrations of salt or salt products can vary the way the current will flow through a gel?

A. I am aware of some of the theory on gel electrophoresis I am not an expert in that field by any stretch of the imagination.

Q. Are you aware that, as I stated, that maybe salt or salt products can effect the running of the current through the gel and alter it?

A. That is correct. I am aware of that, yes.

Q. And is any of these -- in the materials that you use in the preparation of your runs are -- any of them have a salt quality base or -- any of your chemicals?

A. Yes. There are salts in those buffers we use.

Q. Buffers you use. So if there was an uneven concentration of a buffer it would effect the current flow.

A. It would be difficult to imagine how one could achieve an uneven distribution of salt in the buffer. It is a liquid. It is well mixed. I don't really see how that could occur.

Q. But when it solidifies.

A. It solidifies in a homogeneous fashion. You mean the agarose itself. It is well mixed and it solidifies in a homogeneous fashion.

Q. When the fragments are moving through the gel what prevents some fragments from getting -- let's say the smaller ones -- what prevents their movement from being restricted by bigger ones in front of them? It seems to me that when you digest all this and you throw it in, it is just like a can

of worms. All the big ones and the little ones mixed up together.

A. That is a good analogy.

Q. I may be over-simplifying it.

A. No. That is a good analogy. It is like you have large worms and small worms. That works, yes. What prevents them? Well, the separation occurs very quickly in the very initial part of the run. There is some blockage and if you heavily overload your sample it can cause problems because you will have large molecular weight DNA that will trap small molecules, but in the circumstances in the manner in which we load our gels, we do not add that much DNA that it is going to cause a problem, so that the smaller fragments have no difficulty sneaking through the mass of DNA that they are in originally. In fact they do that much more quickly than they do going through the agarose gel itself.

Q. I am thinking of analogy -- something like when you are watching the Boston marathon. You wonder how in heck how can you ever get through all these people to get out in front.

A. Empirically it works.

Q. Could it also help slow them down though, the faster moving fragments?

THE COURT: The guys who end up in front start in front. That is why they have low numbers on their placards.

Q. I am just considering that the smaller size fragments that come down there, they have got to get by a whole lot of big fragments. Bigger fragments all the time. It is hard to think they get out in front right away and then, you know, it is free going.

A. Well, it happens because the DNA is loaded in a buffer. It is in a liquid so as soon as you snap on a current you have the small fragments migrating very quickly through that buffer and they enter the gel. That is when they start to slow down. You are not talking about large fragments blocking the pores of the gel so that the smaller fragments can't get through. The separation really starts in the sample well itself.

Q. It just seems while they are in liquid form, if it is in liquid form and if they were still in fragments, they would all have their nose stuck into the gel just like at a starting line and --

A. There are very many, many pores through which they travel through so -- empirically it works.

Q. Would some of the pores, as the smaller fragments make their way through the gel -- I am thinking about electricity now and it is just like water. Pristine water takes the path of least resistance so if the smaller gels are going to make the path, cut their way through the jungle, then the big ones could, if they get on a good path, got free rolling. Is there any compensation for that?

A. No, there is no compensation for that. It doesn't quite work that way to the best of my knowledge.

Q. To the best of your knowledge.

THE COURT: You are heading for a Nobel Prize.

MR. FURLOTTE: That is the problem with an analytical mind. (laughter) Never satisfied until you know it all. Unfortunately I am going to die unsatisfied. I think maybe we could set up the slide again so that I can

question you on the slide process as you started on direct examination might be the proper order.

Q. I understand -- which slide is that now?

A. That is locus D2S44 for the first membrane.

Q. As I understand, that is not actually the first probing you did on that gel; is it?

A. No. That is the first probing I did on that gel and that is the first exposure of that probing.

Q. That is the first exposure?

A. That is right. Dated '89, November 10th I believe.

Q. Could you run the D4S139, the first one?

A. D4S139 was the third probing. That is on the test gel. No interpretation was made from the test gel.

Q. And maybe just to explain to the court the test gel. There is a specific probe that is used for the test gel.

A. The test gel isthe test for the restriction in the nucleus to make sure everything worked correctly. In order to dot hat one runs approximately 1/30 of the sample on a gel and stains it to see if one can determine whether the DNA has digested appropriately. At that time I was often blotting my test gel just to see if I could get a result from it. Now, when I was doing this I was testing with our most sensitive probe, D4S139, because it would be the one most likely to give me a result. In most cases, particularly in a case like this where I am dealing with very, very small amounts of DNA, 1/30 of the sample was not enough to detect anything. It is a practice we have since discontinued.

Q. Okay. On this membrane there would have been a test gel run prior? Was this a separate one altogether?

A. This is the membrane produced from the analytical gel which is -- the bulk of the sample is loaded on the analytical gel, depending on the amount of DNA present in the original sample. The test gel is the -- simply the southern blot of the transfer of the test gel which contains approximately 1/30 the amount of DNA present in this gel, the analytical gel. I have presented in all cases -- all the slides I have presented is the result of the analytical gel, the gel that I use for my interpretation.

Q. So for clarification, when you look at this probe, the D2S44, there is no possible way that there could have been dark spots or fragments on there because of prior improper stripping?

A. No. This is the very first probing.

Q. This is the very first probing. I am just wondering what the interpretation of these dark bands could be there? 109(f). Here, here, here, down here. (indicating)

A. They would be degradation products.

Q. That would be degradation?

A. Due to degradation.

Q. Due to degradation.

A. This is the female fraction of those swabs. Often the femal epithelial cells are partially degraded by the presence of bacterial yeast endogenous flora. They are not actually bands in the original autorad. As you see here they are more smears and that sort of stuff. The contrast of the slide makes it appear

more as though they are bands.

Q. Now, in the separation process when you notice that there is degradation say in the female fraction -- you continue to call it the female fraction -- which hasn't been extracted, could some of this possible degradation be extracted over into the male fraction when you are doing your extractions?

A. Most of that degraded DNA would end up in the female fraction just by the nature of the differential extraction because the cells are already lysed. The DNA is broken. All you are doing is solubilizing the DNA in the first fraction of the differential extraction. You don't have to break open the cell in order to release that DNA. Therefore, by nature of the fact that these things are degraded it would reside in the female fraction to the greatest extent.

Q. To the greatest extent. There could be some over into the male fraction --

A. I won't say it is impossible, no. As you can see in here/the female fraction, 109(f), there is a fair amount of degraded DNA and by this smear present in 109 you can still see some degraded DNA.

Q. You can still see some. Would that also -- in exhibit 140(a), lane 5 is it?

A. Yes.

Q. Would this also account for degradation?

A. Yes. Some of this bottom band here is non-specific banding. I wouldn't attribute that to degradation at all. That is just non-specific binding of this probe. It just didn't wash as well as it might have.

Q. Did I understand you to say that this could be possible degradation?

A. There is some degradation in those lanes because you can see some smearing.

Q. I understand that is on a pristine sample.

A. Oh, by no means at all are these pristine samples.

Q. It is not a pristine sample?

A. No.

Q. A blood sample taken from a -- that did come from a blood sample taken from Linda Daughney did it not?

A. Yes.

Q. And blood samples are not pristine samples?

A. If they are placed in a EDTA tube, a purple-stoppered tube, refrigerated and given to the lab in two, three days, then I would consider it a pristine sample.

Q. It is not just a matter -- just because it wasn't a sample that was taken out -- scraped up off some floor, that does not mean it is not pristine.

A. By no means at all.

Q. When you get extractions,like the swabs you were using in the extractions and you do get some degradation over into the two fractions, could some of the degradation show up as very light and faint spots? Like here. (indicating) That is very light and faint. You mentioned that this was degradation which seems to be a much darker spot than these spots over here.

A. No. You wouldn't be resolved as a band such as that because, look, you see what looks like a band here and if you look at a carryover product, there is no distinct band there at all. So what you are doing

is very little carryover from one fraction to the other and it doesn't appear as a band in this particular fraction. It would more result in a smear that one could not determine in banding.

Q. If, over here in lane 3, if there was nothing in that lane whatsoever, would you call those bands?

A. Yes, I would.

Q. Are there many scientists who would not?

A. I am not aware of any scientists that have even looked at this particular case that would not. I can't speak for all scientists in the world. But in my opinion anyone experienced in reading autorads and experienced in the RFLP technology would call those bands. I am -- not particularly from this particular depictation of the autorad. They would look at the original autorad, of course. They wouldn't look at a slide.

Q. Is there some kind of movement on amongst the scientists in the general community to have a -- I guess a minimum degree of intensity that must be shown before a band can be declared?

A. It has been mentioned by some I think defence experts that it might be appropriate to do that. It is very difficult to define that. I am not aware of any movement towards that at this stage.

Q. Some of them have suggested the intensity of bands being called within the lanes ought to be of equal intensity of the marker lanes. Are you aware of that?

A. No, I am not and I don't see the need for that in my opinion.

Q. Okay. Maybe we could go on to the next slide.

A. The next slide is a darker exposure of that same autorad. Do you want to go on to the next probing or --

Q. No. We will leave it there for now. Again this would be exhibit 140(a), lane 5. That would be a clear example of degradation. Wasn't so obvious in the last autorad.

A. No. That is more non-specific binding. There is some small degradation in that lane but it is really enhanced by the slide -- the contract of the slide.

Q. How can you distinguish between degradation and non-specific binding?

A. One can look in between the lanes to see the non-specific binding. You can't see it there. They look clear. They look as though it is clean but actually it is quite grey. What I would call some degradation is the fact that you can actually see the lane -- the smear in the lane itself in the background. You can see the background here in between these bands which would indicate to me some degradation. Non-specific binding is more what one can see between these lanes. It adds a certain amount of darkness to that lane and again there is some evidence of a small amount of degradation on that lane by the fact that it in fact is a little darker. This -- the only way to really look at this is through the original autorad. This is a very contrasting slide.

Q. Okay. In lane 19 which I believe in the other one you had bands here and here in lane 3.

A. Yes.

Q. Those are the bands here in lane 3 and very light over here again.

A. That is true.

Q. What is this up here? (indicating)

A. That is non-specific binding. If you look straight at it it is not in a lane.

Q. You know, be untrained I would look at that and I would almost think that that would be more apt to be a band than this one here.

A. In fact it is not even in a lane. It is between the lanes.

Q. It is not even in a lane?

A. No. It is between this lane and this lane.

Q. Got crippled at the starting line did it?

A. Yes.

Q. I feel you -- this is a band here and this is also a band? (indicating)

A. This is a band. That is not a band. This is a band up here.

What is this here?

Q. This is a band up here. /That looks to be right in the lane.

A. Excuse me?

Q. This here. That looks to be right in the lane.

A. No. Again it is partially between the lanes there. It is another spot of non-specific binding.

Q. Boy, that is a close call, Doctor. I will stand back here.

A. You can see where the lane is. It is partially in and partially out of the lane.

Q. But there is a possibility of bands or fragments shifting sideways too. That is known to occur.

A. I have not seen it in my experience.

Q. Not in your experience but you know that it does happen.

A. I have never seen it in our gel system and that is looking at thousands of samples so --

Q. But you know it does happen in some people's system.

A. I have seen a photograph and somebody saying it happened. I don't know whether I agree with that or not. I would have to really see the sample itself.

Q. I am concerned, Doctor, if that was a band and this was a band which / seems to have shifted sideways, they are almost in the same position. If those could be considered bands, Mr. Legere would have to be excluded would he not?

A. They aren't bands. They have not shifted.

Q. If they were bands.

A. They aren't bands and they are not approximately the same position by any stretch of the imagination, and I can't agree with that opinion of yours. Obviously this technology requires some experience and training and if we show the next slide you will see that those bands -- that you call bands -- are not present. That it is in fact non-specific binding.

Q. Show the next slide, Doctor.

A. This is the same probing.

Q. Same probing. Not there.

A. Same probing. They are not there. This is a reprobe

Using the same probe they are not there which confirms what I have been saying is non-specific binding.

Q. Was the other one a different probing or was it just exposed a longer period of time? Go back to it.

A. The last one?

Q. The last one.

A. It is a different probing and was exposed for 88 hours. You can see that there.

Q. Yes. How long was this one exposed for?

A. Ten days.

THE COURT: Was the earlier one a reprobing of the slide before that again?

A. No. It was a longer exposure of the same probing.

THE COURT: Of the same --

A. That is why we saw some background in the first one and with the longer exposure it had increased to that extent.

THE COURT: I guess you had explained that on direct examination.

A. I believe I did.

THE COURT: Yes, you did and I forgot it.

Q. So this is the third slide we have in the machine right now; is that right?

A. That is correct.

Q. -- since we have started. And the three are all of the same probing and the first one you showed was on for how many hours? Let's go back to them again.

A. 22 hours.

Q. The next one was 88 hours.

A. 88 hours.

Q. The only reason that we see this, these two bands up here -- I am sorry. You are not calling it bands. -- but the reason we see these two black marks up here is that they were actually there the first time but now they have been exposed longer and that is why we see them.

A. Yes. Tehy are very faint there. These two blotches. They appear darker in the longer exposure. There is no great revelation in that. In fact one would expect that to happen because a longer exposure gives the radioactivity non-specifically bound to that area longer time to expose the film.

Q. Why -- maybe another stupid question. Why would non-specific binding show up more than specific binding just because it is exposed longer?

A. Well, particularly with the first probing this can be a difficulty because often there is little fragments of agarose or stuff from the original gel stuck on the membrane and it will bind the probing. After stripping this you find subsequent probings, the background -- non-specific background decreases.

Q. Actually what you are saying is that -- if I understand you correctly -- that as the probes will go and stick onto their complimentary base pairs there may be portions of agarose gel that also sticks to the probes which is drug along through the gel.

A. No. The gel is already run. This is on the transfer. This is little small pieces of agarose stuck to the membrane.

Q. And that happens first on the transfer.

A. That occurs on the transfer. It -- during the transfer the gel often dries and sometimes with washing you don't get all the little pieces of agarose off and they will entrap the probe. As I say, when you strip the membrane at high temperature this generally washes off all the agarose so that you won't see as much non-specific binding in subsequent probes.

Q. Go on to the next slide.

A. This is the reprobing using D2S44. Again we don't see the non-specific binding that we saw in the original probing. The background is much cleaner.

THE COURT: This was ten days?

A. This is a ten day exposure as indicated here. "10d". Ten days.

MR. WALSH: Is that on the light box now?

A. No.

Q. Is this the original of what is on the screen now?

A. Yes.

Q. Could I have your laser for a minute please? You see that mark here in this lane (indicating) is very light like some of the other light bands.

A. Where is it again?

Q. There. (indicating)

A. It is not on the original that I can see.

THE COURT: I think it is a fly.

A. No, I can't see it on the original. I think it must be -- again a photographic --

Q. Right. If it was an original -- just for understanding the system here -- Mr. Legere again would be excluded because it would go right in the middle of these two bands.

A. And if I could not account for that band some other way as carryover from the female fraction from the vaginal cells, if that were a band, I -- yes.

Q. You say that would be the band shared from the female fraction.

A. Yes.

Q. If that was a band and was right in between -- just to understand the principle, Doctor --

A. I understand the principle that we are talking hypothetically. If there was a band there I would exclude him as being a donor for that sample.

Q. All right. Go on to the next slide.

A. This next slide is locus D1S7 from membrane #1.

Q. Again, Doctor, there are in lane 109 -- this lane.

A. Exhibit 109. Lane 12.

Q. Is this due to partial degradation or could those possibly be bands?

A. They are more smears. It is more due to degradation.

Q. Pardon?

A. It is degradation.

Q. Degradation, eh. If they were bands that would mean Mr. Legere could be excluded.

A. As being a donor for those particular bands, yes.

Q. Because these two would be the female fraction lined up.

A. Yes. Those two bands match exhibit 115(b), the two bands here. These are the known blood samples from Donna Daughney. You will see again that in the sample there is degradation and on the slide it appears as though these are bands.

Q. This again here in lane 109(f) the female fraction?

A. That is a female fraction. That is the carryover.

Q. If that was a band that would again eliminate Mr. Legere.

A. If it were a band, but it is not a band. It is degradation.

Q. How can you tell it is not a band?

A. You can see the same sort of thing on this particular sample. I have never called Mr. Legere a match on this particular band.

Q. No. I am not saying you would call it a match because of that but I am wondering how you distinguish between bands.

A. Again I will mention I don't do it from slides. Take a look at the autorad. They are not bands. That looks like a water mark in fact. This is a smear. Again the slide itself is more contracting.

Q. If we look at the original here in these lanes --

MR. WALSH: You will have to speak up I think. The court stenographer is having a hard time to hear when you have your back to her.

Q. Which lane is this again?

A. That is lane 109(f).

Q. 109(f). If you look in between the two high intense bands there looks to be a black smear across there.

A. Degradation product.

Q. Degradation product. And it is another -- below the bottom band which you called there is another degradation product?

A. Yes.

Q. And it would possibly match with the degradation product in lane 4 which is Donna Daughney. Could Donna possibly have three bands?

A. No. I would conclude from my experience and my opinion that is degradation product. There is no three band pattern there.

Q. You admit this degradation product in lane 4 and the degradation product in -- what lane did we say that was?

A. 109(f).

Q. They would appear to be about the same migration rate?

A. No. In fact this one is lower.

Q. But if it was a band it would exclude Legere. I know you don't agree it is a band, but if it was it would exclude Legere.

A. He could not have donated that band, no, if it were such a band.

Q. I am just wondering, Doctor, if something so light as this can be a band, why could not these two be bands just because they got dark backgrounds? How would you distinguish them?

A. They have dark backgrounds but they are also not distinct. Again the slide here is an exaggeration of what one sees in the original. In the original it doesn't look quite so distinct as it does here. These are just faint smudges that have been enhanced during the photographic process. It is more an irregular in shape. It is almost a circle there. On this it is a smear.

Q. Okay. Then if we move over here to exhibit 134(f) do we have -- right in line again and you can't tell that it is irregular but you can still see the little darker smudge, which, if you took this and you put it on top of that you might end up with the same thing.

A. No. They are not bands. They are smudges.

Q. Is it possible that scientists would disagree with you or do you think your opinion is absolute?

A. I don't think a reputable scientist would make a call like that.

Q. What happened here? What would cause that?

A. That is a partial transfer.

Q. What do you mean by partial transfer?

A. Well, the band itself, the fragments themselves in that area didn't transfer completely so that we have some missing.

Q. Onto the membrane. Okay.

THE COURT: We are probable right in the middle of this are we, Mr. Furlotte?

MR. FURLOTTE: Yes, we are far from --

THE COURT: Yes, but I mean there is no point in waiting another ten minutes for --

MR. FURLOTTE: No. I don't think so. There is no good point to stop at.

THE COURT: I think we will stop there. It is ten to five and --

MR. WALSH: Can we determine whether we are finished with this slide? D1S7?

MR. FURLOTTE: Yes, I believe I have finished with this one.

(COURT ADJOURNED TO MAY 10, 1991 at 9:30 a.m.) 4:50 p.m.

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK

TRIAL DIVISION

JUDICIAL DISTRICT OF FREDERICTON

B E T W E E N:

HER MAJESTY THE QUEEN

- and -

ALLAN JOSEPH LEGERE

AFFIDAVIT

I, Nancy Patterson, make oath and say as follows:

1. THAT I am a stenographer duly appointed under the Recording of Evidence by Sound Recording Machine Act.

2. THAT this transcript is a true and correct transcription of the record of these proceedings made under Section 2 and certified pursuant to Section 3 of the Act.

3. THAT a true copy of the certificate made pursuant to Section 3(1) of the Act and accompanying the record at the time of its transcription is appended hereto as Schedule "A" to this affidavit.

SWORN TO at the City of Fredericton, Province of New Brunswick, this 30th day of May, A.D., 1991.

BEFORE ME:

Verna Peterson
A Commissioner of Oaths

MY COMMISSION EXPIRES
DECEMBER 31, 1994

SCHEDULE "A"

RECORDING OF EVIDENCE BY SOUND RECORDING MACHINE ACT

CERTIFICATE

I, Nancy Patterson, of Harvey Station, New Brunswick certify that the sound recording tapes labelled

R -vs- Legere

initialled by me and enclosed in this envelope are the record of the evidence (or a portion thereof) recorded on a sound recording machine pursuant to Section 2 of the Recording of Evidence by Sound Recording Machine Act at the voir dire hearing held in the above proceeding on the 9th day of May 1991 at Fredericton, New Brunswick, and that I was the person in charge of the sound recording machine at the time the evidence and proceedings were recorded.

DATED at Fredericton, N.B. the 9th May 1991

Nancy Patterson