

The Limits of Cross-Examination

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INTRODUCTION

The advent of *Daubert* and *Kumho* hearings were thought by many to be the panacea and would expose junk scientists. The expectation was based on an assumption that pseudo experts would be recognized by judges and juries once it was shown that their methodology was flawed, their data interpretations subjective and their error rates unknown. Unfortunately, junk scientists appear on the stand well-dressed and articulate. These pseudo experts believe in their junk science. Their cross-examination is an inquiry into faith-based opinions.

However, *Daubert* and *Kumho* increase the judge's awareness that faith-based opinions may be subject to critical appellate review and may permit a wider scope than was previously permitted. This paper explores that scope and illustrates cross-examinations intended to impeach the character of the witness and convey to the judge and jury that the witness is not only scientifically incompetent, but also morally deficient.

Even in those state appellate courts that restrict the gatekeeping function of the trial judge and invoke the formulaic justification that

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cross-examination is adequate to test the reliability of expert opinion evidence, the impact of *Daubert* and *Kumho* on the scope of cross-examination is apparent. Wisconsin appellate courts are among them.

Unlike in the federal system, where the trial court has a significant “gatekeeper” function in keeping from the jury expert testimony that is not reliable, *see, e.g., Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125 L. Ed. 2d 469, 113 S. Ct. 2786 (1993) (scientific expert testimony); *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S. Ct. 1167, 143 L. Ed. 2d 238 (1999) (expert testimony in general), the trial court’s gatekeeper role in Wisconsin is extremely limited:

The rules in regard to the admission of expert testimony are also clear. Wisconsin Rule of Evidence, sec. 907.02, Stats. Testimony by experts, provides that, if scientific or specialized knowledge will assist the trier of fact to determine a fact in issue, a qualified expert may testify. As the commentary to Rule 907.02 points out, under Rule 907.02, expert testimony is admissible if relevant and will be excluded only if the testimony is superfluous or a waste of time.

State v. Walstad, 119 Wis. 2d 483, 516, 351 N.W.2d 469, 486 (1984). Under Wisconsin law, scientific testimony is admissible if it is “‘an aid to the jury’ or ‘reliable enough to be probative.’” *Id.*, 119 Wis. 2d at 519, 351 N.W.2d at 487 (citation omitted). An opinion for which there is no proper foundation—for which the witness has no, in the words of Wis. Stat. Rule 907.02, “scientific, technical, or other specialized knowledge”—is not “reliable enough to be probative.” Simply put, the witness must be first qualified as an expert under Rule 907.02 before he or she can give any opinion within the asserted area of expertise:

The fundamental determination of admissibility comes at the time the witness is “qualified” as an expert. In a state such as Wisconsin, where substantially unlimited cross-examination is permitted, the underlying theory or principle on which admissibility is based can be attacked by cross-examination or by other types of impeachment.

Walstad, 119 Wis. 2d at 518-519, 351 N.W.2d at 487. *See also State v. Peters*, 192 Wis. 2d 674, 690, 534 N.W.2d 867, 873 (Ct. App. 1995) (“Once the relevancy of the evidence is established and the witness is qualified as an expert, the reliability of the evidence is a weight and credibility issue for the fact finder and any reliability

challenges must be made through cross-examination or by other means of impeachment.”).¹

A cross-examination of experience-based experts would be more effective if one could inquire directly into the *Daubert* and *Kumho* admissibility criteria. Unfortunately, a meaningful cross-examination on the validity of such methodologies requires a witness who is more—or less acquainted with the application of statistics to small data samples and a jury willing and able to evaluate the limitations of a lack of such analysis placed on the reliability of inferences. Few expert witnesses in non-academic disciplines will candidly accept the need for statistical analysis and the fallibility of a methodology with such a lack.

STYLE vs. SUBSTANCE

A judge who is either unwilling or unable to assess the reliability of an expert opinion and a jury with no understanding of the scientific method compel a cross-examination which is more style than substance. The examination must convey to the jury that the witness is unreliable rather than that his methodology is flawed. While a jury may intuitively recognize that witnesses who are salaried employees of the prosecution have a bias against defendants, unless this bias is demonstrated in their responses, such impeachment is minimal.

The cross-examination must impeach the character of the witness. He must give answers which are implausible or unreasonable. The jury must be encouraged from such responses to find that the witness is biased and untrustworthy and from this infer that his opinions are unreliable.

Simply put, no matter how well credentialed and conversant in an established field, an expert may still testify to falsehoods. These falsehoods may involve generalities of the substantive content of the relevant field or its methodology, or as either applies to the particular facts of the case at hand. Focusing attention on the field and the witness's credentials to the exclusion of the testimony in context risks encouraging abusive expert testimony practices—the now legendary junk science. Thus, the district judge must determine that the testimony is relevant to the task at hand in a localized rather than a global fashion, where that means that the expert is testifying on the basis of knowledge applied to the

¹ Green v. Smith & Nephew AHP, Inc., 617 N.W.2d 881, 890-91 (Wis. Ct. App. 2000).

facts in a reliable manner.²

While a contextualized appraisal has much to commend it, the implication of this approach is that the court's admissibility decisions are case-specific. The *Daubert* hearing must be broader. The court must be urged to consider the responses of the proposed expert in the context of like responses by similar experts in other cases. The court should be urged to find a pervasive similarity of unreasonable and implausible responses and to conclude that the methodology reflects a systemic unreliability.

INSTRUMENTATION vs. METHODOLOGY

This systemic unreliability is most apparent when the expert's instrumentation is scientifically acceptable, but his methodology is not. The reliability of the conclusions of an astrologer is not enhanced by his reliance on computer-driven radio telescopes. The opinions of a polygrapher are not validated by his use of sophisticated instrumentation for the measurement of physiological variables. The elegance of the instrumentation masks the flaws in the interpretive method.

The direct examination of experts in non-academic disciplines is largely devoted to the accuracy and sophistication of their instrumentation and that this instrumentation is regularly employed by scientists in laboratories, universities, and industry. This testimony, which confuses instrumental techniques with methodology, deflects the judge and jury from an appraisal of the validity of the inferences and interpretations the witness has drawn from his data.

In the non-academic areas of fingerprints, polygraphs, handwriting, paint comparisons, fiber comparisons, glass comparisons, tool markings, firing pin and land and groove comparisons, and the other "forensic" inquiries explored in the Laboratory Proficiency Testing Program³ in the 1970's, this misplaced

² Ronald J. Allen, *Expertise and the Supreme Court: What Is the Problem?* 34 SETON HALL L. REV. 1, 5 (2003).

³ The Crime Laboratory Proficiency Testing Research Program was undertaken by the United States Department of Justice, Law Enforcement Assistance Administration, National Institute of Law Enforcement and Criminal Justice. The purpose of the program was to determine whether the vast sums provided by the government to state crime laboratories resulted in accurate forensic evaluations. Twenty-eight sets of samples were submitted to each participating laboratory. The state laboratories agreed to participate in the program on the condition that a laboratory could refuse to test any sample for which it believed it did not have sufficient expertise to evaluate. A second condition was that the test results for a laboratory would remain confidential and the laboratory would only be identified in the final report by a random number. The Justice Department agreed to these

reliance on instrumentation is most evident. The witness does not and probably cannot explain the statistical assumptions upon which his opinion is based. The witness asks the jury to equate measurement accuracy with interpretive reliability.

THE SAME AND NOT THE SAME

These witnesses testify to a two-person show-up. They compare data and opine that two data are from the same population: two fingerprints from the same finger; two handwriting examples from the same scrivener; two fibers from the same garment; two marks by the same tool; two cartridge casings from the same gun; two glass fragments from the same headlight; two paint samples from the same automobile; two spectra from the same controlled substance.

The elegance of the measuring device masks the definitional problem. The analyst examines data and asks the question "Are they the same?" Is the latent fingerprint the same as the exemplar? Is the IR spectrum the same as that of the known controlled substance? But data are never exactly the same and the question always implicates the real question: Are the data close enough to warrant the opinion that they have a common origin? An answer to the question requires knowledge of the variability of the population and the variability of the measuring device.

This knowledge can only be obtained by statistical analyses. In the absence of such analyses, "good enough" is unknowable and undefinable. Inevitably, these statistics are not known and the analyst must rely on his own judgment and experience to answer the question whether the data are the same.

INFERENCES FROM ILLUSTRATIONS

While this facade of scientific reliability can be academically discussed, its flaws are more vivid in the responses of the witness. The responses of the witness must intuitively convey the unreliability of opinions in which the sophistication and complexity of the instrumentation falsely convey the appearance of scientific legitimacy and validity.

The cross-examiner is faced with a formidable problem. The flaws in methodology can only be perceived by a judge or juror with some understanding of statistics and probability theory. A meaningful cross-examination can be accomplished only if the witness also has some understanding of these disciplines. The witness

conditions.

cannot be impeached with his unfamiliarity with these concepts unless he acknowledges their significance to his interpretative process. And this he usually will not do.

An example is the forensic analyst who conveys in *voir dire* and direct examination that his methodology has its foundation in the principles of physics and chemistry and his opinions are formed by the same inferences that scientists employ. The expert in such testimony implies that scientific instrumentation is equivalent to scientific methodology.

An illustration of this implication appears in the testimony of forensic analysts who opine that the identity of the substance they have examined is the same as that of some controlled substance. These opinions are based upon a visual comparison of infrared or mass spectra.

The following cross-examinations appear in actual trials over many years. The examples are from the testimony of average analysts in comparable prosecutions. They illustrate the advantages of a *Daubert* hearing in which the judge may consider the testimony of other forensic analysts and infer the unreliability of the methodology from the similarity of their responses.

It is difficult, if not impossible, to formulate general principles for the cross-examination of experience-based experts. The principles must be inferred from examples. While examples are available from many fields, the cross-examination excerpts that follow are drawn mostly from the testimony of forensic analysts in drug trials. It is hoped that by this limitation the inferences will be sharper and more clearly discernable. A limitation of the excerpts to cross-examinations in drug prosecutions reflects the similarity of responses and the systemic unreliability of the interpretive process.

After an extensive direct examination in which the analyst describes in exquisite detail the workings and accuracy of a spectrometer and how it has been an accepted instrument in the scientific community for decades, a cross-examination will focus on four aspects of the opinion testimony: (1) the attitude of the witness toward recognized and authoritative scientific writings; (2) the attitude of the witness toward the comparison of his data with published data and tests performed by other analysts on the same substance; (3) the knowledge of the witness of the basic scientific principles upon which the instrumentation is based; and (4) the subjective or impressionistic nature of the process by which his opinions are formed.

The areas of inquiry are a response to the direct examination.

An understanding of the literature and scientific principles that discuss and underlie spectrometry is probably not necessary to the proper operation of the instrument. However, the witness has equated instrumentation with methodology and has compelled the cross-examiner to accept this thesis. The object of the examination is not to establish that the instrumentation is scientifically invalid, or that the witness is unread in the scientific discipline, but that the character of the witness is that of one who cannot be trusted.

REFUSAL TO RECOGNIZE AUTHORITATIVE SCIENTIFIC WRITINGS

The principles upon which spectrometry is based can be found in numerous recognized treatises. If the witness will acknowledge that some treatise is authoritative, he then can be cross-examined upon any differences between his understanding of scientific principles and that of the treatise's author. However, a difference in the understanding of scientific principles can be explained on redirect examination. The cross-examination should foreclose such rehabilitation.

As the following examples reflect, this initial inquiry into authoritative treatises can yield implausible responses.⁴

Q You understand, do you not, Mr. _____, that, if I can get you to tell me some books, some treatises in chemistry that you rely on for your opinions, I can then cross-examine you concerning the contents of the book. You understand that, don't you?

A Yes, sir.

Q Now would you tell the jury the title of one book, one book in the field of analytic chemistry, since the beginning of time in any language, by any publisher, by any author, that you say is sufficiently authoritative so that I can ask you some questions about it?

A I don't know of a text like that

Q Not a single one?

A No, sir.

Q Can you give me a portion of one text in any language by any publisher about the infrared spectrophotometer that you consider sufficiently authoritative so that I can cross-examine you over whether you understand the instrument?

A No.

⁴ The excerpts that follow have been taken from actual trial transcripts and have, in places, been edited to preserve syntax and omit unnecessary discussion. Copies of the original transcripts are on file with the Author.

Q Is there any treatise that describes the infrared spectrophotometer that you used upon which you based your opinion in this case that you consider to be authoritative?

A No.

Q You used a gas chromatograph in this particular series of tests, didn't you?

A Yes, sir.

Q Is there any field, any book, any treatise, in any language, concerning the theory or operation of the gas chromatograph which you believe to be authoritative?

A No, sir.

Q Is there any book or any treatise by any publisher, by any author, in any language that you consider to be authoritative in the field of color reagents?

A No, sir.

Q You are certain you have E.G.C. Clark's book on analysis of drugs in your laboratory, don't you?

A I believe we do.

Q You use that as your reference value?

A I don't recall.

Q Now, you understand how if you had used Clark that what we could do was go find a copy of it in the library and just bring it in here and compare it to your chart there and see what kind of job you did? You understand how that could work?

A Yes, sir.

* * *

Q There is a DEA manual called the Analytic Manual put out by Mr. Andrews' organization in Washington that's got infrared spectra in it. You have seen that, haven't you?

A I don't recall.

Q Give me the name of the author of the book that had the reference values in it, so that we can go to that book and compare the values in the book with the values that you got on this chart here. You understand what I want?

A You want the author's name?

Q I want the author's name that you used for the reference values so that we can see whether or not you did a better job than the—

A I don't recall author's names.

Q Well, what did the book look like?

A I don't recall.

Q Do you know the title of the book?

A No, sir.

Q I imagine you don't know the publisher either?

A That is correct.

Q Well, was it a book that was in your laboratory?

A Yes, sir.

Q Do you remember anything at all about the book, whether it was a big book or a little book, or anything like that at all?

A I would guess it was a hardbound book, but I am not sure if it was hard bound, we have both.

Q Not sure whether it's hard bound. Well, that certainly gives us a lot to go on, doesn't it? I guess we can't very well compare the sample that you've got with the reference values, can we?

A Doesn't look like it, no.

Q Well, you can see how that sort of makes it difficult to cross-examine a fellow? You can see the problem, can't you?

A Actually, no.

* * *

Q Any chemist whose work you recognize as being authoritative in any field of chemistry?

A There are no works that I recognize.

Q You recognize no works as authoritative?

A There aren't any authoritative works.

Q No authoritative works in the field of chemistry, is that correct?

A That is correct.

* * *

Q Well, you took sixteen credit hours of chemistry, is that right?

A That's correct.

Q Why don't you give me the name of some book that you consider to be a good enough reference book, so that I can ask you some questions and see whether or not you agree or disagree with the authors?

A Again, Mr. Shellow, there are many books that we use.

Q Give me one author that you think knows enough about the field so that I can ask you a question about the work he did and see if you have any understanding of this?

A I cannot give you the name of an author.

Q You read books in chemistry by people who presumably had a greater knowledge than you did, right?

A That's correct.

Q Can you think of any of those, any of those books that you agree with enough so that I can ask you some questions about it?

A No, I cannot.

* * *

Q Give me one book upon which you rely for the tests that you performed on heroin. One author that says, "That's the way to do it," and one author that says, "Those are the right results." Just one.

A I've already told you, I don't rely on anyone.

Q Sir, somewhere there is someone who says, "If you've got heroin in the instrument, these are the results you should get." Somewhere there's somebody other than yourself who considers himself an expert in the field and who has written about it. Who?

A I would not consider them authoritative . . .

Q You mean, as far as you, sitting on the stand in Seattle today, are concerned, there is nobody who has written in any language at any time since the infrared spectrophotometer was invented in the 1920's that comes up with the results you get for heroin and says, "That's what you ought to get."

A I didn't say that.

Q Then give me the name of somebody who does.

A I don't recall.

* * *

Q Is there a series of books that appears in every university library in the world, to the best of your knowledge, that analytic chemists refer to as the Bible of analytic chemistry, a 50-volume series by Bylshtein (phonetic)? Are you familiar with it?

A I had to go through it when I was in school. It is German. It's very old.

Q You recognize the data in there as being authoritative?

A No.

Q Well, as you close your eyes and look at your shelf of books in your library in the laboratory, is there any book, any treatise, any volume written in any language at any time that you do consider to be authoritative in the area of the identification of heroin by infrared spectrophotometry? One book and the author, please?

A There is no such thing in science as an authoritative book that would explain anything perfectly without mistakes. That is contrary to science. Science questions everything.

Q Give me one book upon which you rely for the tests that you performed on heroin. One author that says, "That's the way to do

it,” and one author that says, “Those are the right results.” Just one.

A I’ve already told you, I don’t rely on anyone.

Q We’re not saying anyone’s perfect, sir. We’re not saying any book has all the right answers. We’re not saying that science shouldn’t question everything. I’m saying, give me one author, one book in any language that agrees with what you’re doing and says that the results that you get are right. Just one.

Q There are many books that say infrared analysis is the way to identify organic substances.

A Give me one book that says, “When you want to identify heroin, this is the test to use and these are the results you should get.” That’s all. Do you understand my question?

A They don’t talk about heroin. They talk about things in general.

Q Sir, somewhere there is someone who says, “If you’ve got heroin in the device, in the instrument, these are the results you should get.” Somewhere there’s somebody other than yourself who considers himself an expert in the field and who has written about it. Who?

A I would not consider them authoritative.

Q You mean as far as you sitting on the stand in Seattle today are concerned, there is nobody who has written in any language at any time since the infrared spectrophotometer was invented in, what, the 1920’s that comes up with the results you get for heroin and says, “That’s what you ought to get.”

A I didn’t say that.

Q Then give me the name of somebody who does.

A I don’t recall. I’m saying I would not rely on anybody, whatever they say, I would agree with. I would question everything.

Q Just as you expect all of us to, right?

A Certainly.

Q Fine. Now, the author, just one—

A I told you I don’t know. I can’t give you one.

Q I don’t ask you to agree with you on amphetamines, cocaine, asparagus, or anything else. Just one person who says that the data that you get is the data you should get should get. Just one.

A I can’t recall.

Q Sir, you understand, do you not-, that if I hold up a book in chemistry of some sort and give you the title of it and say, “Do you consider it to be an authoritative or a learned treatise,” and you say, “Yes, I do, Mr. Shellow,” that then I can cross-examine you over it and

see if you agree with it. You know that, don't you?

A Well, I assume so.

Q But if you say, "No, I don't consider it authoritative, and I don't consider it learned," it goes back in the box and I can't cross-examine you over it because you don't acknowledge that it's authoritative. You know that, don't you?

A As far as I'm concerned, you can cross-examine me on it. But I don't consider anything authoritative.

* * *

Q And what does the literature say should happen if you mixed authentic cocaine with ferric chloride?

A I don't know what the literature says. I know from my own experience if I mix cocaine with ferric chloride that I have not received any red color as I received in this case.

Q What does the literature say should happen if what you have got is authentic cocaine?

A I don't know what the literature says.

Q Are you familiar with the book by Beilstein, the many volumes? That's spelled B-e-i-l-s-t-e-i-n. It's entitled "Organic Chemistry."

A I have heard of it.

Q That's the recognized treatise in the field of organic chemistry, isn't it?

A I don't know, sir. I don't recognize anything as being the "the" recognized treatise.

Q It is certainly a recognized treatise, isn't it?

A Might be, yes.

Q Well, is it?

A I don't know, sir.

Q Have you ever used it?

A I have used it – came across it.

Q Do other scientists recognize it as being a leading treatise in the area?

A It is used by other scientists, yes.

Q Isn't it a fact that it is in every – to your knowledge, it is in every major scientific library in the world?

A Yes, sir.

Q And it has been in every major scientific library for fifty years?

A I wouldn't know that, sir.

Q Isn't that series of volumes based on your understanding,

the first place that every analytic chemist in the world goes to see whether his data matches up with a reported data?

A I don't know where analytical chemists go to match up their data.

Q Where do you go; what recognized treatise do you go to when you tell me infrared chloride – ferric chloride has no real presence in real cocaine, where do you go?

A I wasn't looking for cocaine with ferric chloride.

Q But where do you go to see if your tests are consistent with that other scientists have found all over the world?

A I go to what I have learned in my training course at work and what my personal experience tells me.

Q And so it's accurate to say, is it not, that after performing the ferric chloride test that you don't know what results Beilstein says you should have gotten.

A From cocaine?

Q Yes.

A No, sir. I don't know – wouldn't know what Beilstein says I should have gotten.

Q And you don't know what any other recognized treatise says that you should have gotten, do you?

A No, sir

* * *

Q Sir, the manual contains times for stuff coming out of the column. Right? That's what's in the manual.

A It's for their column and their conditions. It had nothing to do with what I did.

Q Nothing to do with what you do. Now, has it ever occurred to you that the persons who published that big fat manual – that manual must be an inch and a half thick, isn't it?

A Probably.

Q Well, they published it for a reason. Did that occur to you?

A Yes.

Q And the data that they put in there, it was put in there for a reason. That also occurred to you, didn't it?

A That's correct.

Q And when they put chromatographic data in there, when they put data in there that says how long it takes authentic heroin to go through the column they probably put it in there for a reason. Didn't that occur to you?

A That is not the reason they put it in there.

Q But it occurred to you that they did it for some reason?

A Everybody knows they did it for some reason. I have no idea what reason.

Q No idea what reason. Well certainly they put it in there so that people, well, that people who read it, that is, they didn't just put it in there to fill up the pages, did they?

A I assume not.

Q I mean, there are just charts and tables, and you can go to something like heroin, 260 degrees nitrogen and you can see whether it says 3.51 minutes or 26 minutes. That's what you can look up in there, can't you?

A One could look it up, yes. It wouldn't mean anything, but you could do that.

Q And you figure that probably the reason that they put it in there was – well, I guess you said you didn't know. Probably put it in there for the same reason they put in the infrared spectra of heroin and heroin hydrochloride just so they could fill up the pages. Would that be your best estimate?

A I didn't say that. I said I don't know why they put those things in there. I had nothing to do with it.

Q Well, they sent it to your laboratory, didn't they?

A Yes.

Q How many copies do you figure they sent to your laboratory?

A At the time it was one for each chemist.

These responses may have been prompted by the following passage in BASIC TRAINING PROGRAM FOR FORENSIC DRUG CHEMISTS:

Another tactic which might cause trouble is that of mentioning a name, publication or article, and asking you if you consider the person or document to be authoritative. Occasionally, this will take the form of reading a passage from a book. Although you may be convinced that the source is authoritative and you are thoroughly versed in the opinions stated (and are in substantial agreement), the best response is to answer negatively. This will effectively shut off that area of cross-examination.⁵

Confronted with this passage on cross-examination, witnesses have testified as follows:

Q That is, when the book says, that is the training manual says, although you may be convinced that the source is authoritative and in

⁵ BUREAU OF NARCOTICS & DANGEROUS DRUGS, U.S. DEP'T OF JUSTICE, BASIC TRAINING PROGRAM FOR FORENSIC DRUG CHEMISTS 195-96 (1972).

substantial agreement, the best response is to answer negatively. This will effectively shut off that area of cross-examination. Did you follow that advice in your testimony, Mrs. _____?

A When you say authoritative, I do not know what you are referring to, and again, there are many, many reference books that I used. I didn't follow any one's advice; I have gone off my own experience.

Q Did you follow the advice in this book that I just read to you? Can you answer that question yes or no?

A No, I can't answer it yes or no.

* * *

Q Are you familiar with the DEA training manual for chemists?

A Yes.

Q Did you, when you trained as a DEA chemist, did you use that manual?

A The prototype of the manual, yes.

Q Do you remember the discussion in that manual about lawyers asking DEA chemists about authoritative texts?

A I remember there was something about it but I don't remember the specific statements.

Q Would it refresh your recollection if I were to inform you that in substance what your training manual says is that on cross examination a lawyer may ask you whether a particular text is authoritative and, regardless of how authoritative you consider it to be or regardless of how substantially in agreement you are with the statements set forth therein, that the best answer to give is no because that will cut off further cross examination? Do you remember that statement in there?

A I don't remember that it was specifically stated that way.

Q But that was the substance of it, wasn't it?

A I don't believe so. Because that would require someone under oath to perjure themselves.

Q It sure would. Have you seen that book lately?

A The training manual?

Q Yes.

A Not since I got out of training.

Expert witnesses employed by the Food and Drug Administration have expressed the same reluctance to identify authoritative treatises.

Q You belong to learned societies?

A I am a diplomat of the American Board of Toxicology.

Q You do belong to learned societies.

A Yes.

Q You know what a treatise is.

A I am not familiar with the term treatise, no.

Q If I use the word learned book rather than learned treatise, will you then understand what is meant by that phrase?

A I have not heard the phrase learned book used either.

Q There are books that are written in the field of science which are relied upon by other scientists. True?

A True.

Q Usually, at least frequently these books are written by people who are learned in the field. True?

A Again, I am unfamiliar with the term learned.

Q Frequently they are written by persons who are an expert in the field.

A Correct.

Q Can you identify for me a chapter in one of these books that you have read that you consider to be authoritative so that I may ask you questions about it?

A I am not prepared to cite references off the top of my head on risk assessment.

Q Now, in addition to there being chapters in books on risk assessment written by persons who claim they are experts in this field, there also are scientific articles that appear on the subject. True?

A True.

Q And these scientific articles are written, at least it's your understanding, these are written for persons who are in the field of applying risk assessment concepts. True?

A True.

Q And you understand that if you could identify one of those articles for me as being an article upon which you rely in giving your testimony, that then I could ask you questions based upon that article. You understand that, don't you?

A Yes.

Q And so now you know what the next question is, don't you?

A Yes.

Q And the next question is, give me the name of some article in some scientific journal which you believe to be authoritative in the field of risk assessment. Just one.

A And as I said, I have not come prepared to give references

off the top of my head regarding the articles that I have read on risk assessment.

* * *

Q Do you know and can you give me the name and the author of any recognized scientific treatise? And I am now not talking about something published within a Government laboratory. I am talking about a recognized treatise in the scientific community which discusses the methodology that you used to identify cocaine in this case. Do you understand my question, first of all?

A Yes, I do.

Q Please, the name of some recognized scientific treatise that says that what you were doing was the right way to do it. One book.

A No, I cannot name a book.

Q Can you name a book in any language, English, German, French, any language at all, that says that what Miss _____ [the witness] did in this case is the appropriate methodology for analyzing cocaine? One treatise in any language?

A I cannot name a treatise, no, sir.

* * *

Q And are you aware—are you aware of any treatise or publication – recognized publication that tells an analyst like yourself how different two spectra can be and still reach the conclusion and have the analyst still reach the conclusion that they're the same substance? Are you aware of any such treatise?

A I have never read any sort of treatise to that effect.

Q Conversely—and you know the next question – it's going to be have you ever read a treatise, recognized paper, paper in a recognized publication, that tells you how similar two spectra must be in order for you to be able to reach a conclusion that it's the same compound?

A No.

Q Are you familiar with any recognized treatise or publication other than intra-laboratory documents, that is, papers that are in the scientific community, that address the question of whether the methodology you employ to identify cocaine is an appropriate methodology? That is, are you aware of any treatise? And if so, please give me the name and the author.

A I—other than intra-lab, I am not aware of any.

When an analyst has testified on direct examination that he relied upon some scientific text or paper, the jury is encouraged to believe that the analyst read the paper, understood its contents and that the paper supported the data or methodology of the witness.

This inference may be shown to be unsupported.

Q Were some of the articles in Dutch or don't you know?

A I do not recall.

Q Were some of the articles in French or don't you know?

A I do not recall.

Q Were there some articles on that list, the list of thousands and thousands, in Japanese?

A I do not recall.

Q Are there any languages that you speak fluently – I'm talking about scientific fluency – other than English, at the present time, conceding that at the time you took your doctorate you were fluent in German and French?

A No, I don't feel I'm fluent in any language except English.

Q So when you see an article that comes out on your computer where the title is in a foreign language, how do you translate it?

A Titles are generally in English.

Q Were the titles always in English or were the titles in foreign language? Let's take EM Base, for example, those titles were in French, German and Italian, right?

A Some of them.

Q And Dutch. Did you translate those titles?

A Not all of them, no.

Q How do we know that the untranslated titles don't contradict the opinion you gave? Do you understand my question? We don't, do we?

A Are you asking for my opinion?

Q No, I'm asking do you know what the untranslated articles say?

A No, sir, I do not.

Q Did someone suggest to you that it might be a good idea that before you waft an article in front of the jury that you put it in a language that you can read?

A No, sir, nobody suggested that I translate this article.

* * *

Q Well, what is meant – since this has nothing whatsoever to do, you think, with your hypothesis, you certainly agree that you have to understand it before you can reach that conclusion, right?

A I was reading the sentence and taking what I deemed to be its intent they're talking about.

Q No, ma'am. Do you feel it's necessary to understand the

sentence before you can decide whether it supports your view?

A Not – not totally, no.

Q Okay. That is, you can reach a determination whether it supports or doesn't support your position without understanding it in its entirety?

A That's correct. I believe that I can make that determination.

* * *

Q And when the stereoisomer controversy started, then you started looking at some papers in the field, didn't you?

A Yes, sir, in order to keep up with it.

Q Did you read Wilstatter's paper? You mentioned that as being one of the papers that you have read just a minute ago.

A Yes, I read a translation of Wilstatter's paper.

Q Did you read Wilstatter's paper in translation?

A I know that Wilstatter's original paper is in German, I believe.

Q Did you read it?

A I read a paper. I believe it was by Wilstatter. I believe it was dated 1923 and I believe it was in English but I can't swear to it, no.

Q You are under oath. You did swear under oath. Are you prepared to swear that that paper has been translated from the German?

A I can't say yes or –

Q Sir, has that paper been translated or don't you know?

A I would have to back to the laboratory in Chicago, get the paper that I read, look at it, see if it is a translation of Wilstatter and then I could swear to it

Q Sir, is the answer to my question you don't know?

A I guess that would have to be the answer, yes.

UNDERSTANDING OF SCIENTIFIC PRINCIPLES

A second area of inquiry which may prompt implausible responses questions the witness's recognition and understanding of the basic scientific principles upon which his instrumentation is founded.

Again the examination is in response to a direct examination in which the witness has portrayed himself as a scientist engaged in a scientific endeavor. Again the purpose of the inquiry is not to explore the principles of physics and chemistry but to elicit responses from the witness inconsistent with those of a scientist.

Q The underlying principles – the underlying principles that

find their application in this instrument are what are referred to as the laws of thermodynamics, right?

A I'm not aware of that either.

Q Are you aware of the – that there are three laws of thermodynamics?

A I'm not aware that there are three laws of thermodynamics.

* * *

Q Is there any principle of physics or chemistry that you feel you understand well enough so that you can be questioned meaningfully concerning it?

A I guess I don't understand your question.

* * *

Q The FTIR (infrared) and the mass spec are based upon principles of chemistry and physics, right?

A Correct.

Q Are you sufficiently familiar with any of the principles upon which those instruments are based so that you can be asked questions about the principles, not the apparatus – equipment but the principles?

A I am an expert in the operation of the instrument and the interpretation of the data.

* * *

Q Do you have a definition of what a principle is, a principle of physics?

A No, I do not have a definition of that.

Q Let's take – do you know that mass and energy are equivalent?

A No, I don't know that.

* * *

Q Now, Mr. _____, to summarize, going back over everything you've learned about infrared spectrophotometry, everything you've learned about ultraviolet spectrophotometry, everything you've learned about gas chromatography, thin-layer chromatography, column chromatography, color tests, organic chemistry, inorganic chemistry, qualitative analysis, quantitative analysis, physiological chemistry, everything you've learned about calculus, everything you've learned about differential equations, everything you may have learned about functions of a complex variable, everything you may or may not know about stereochemistry. Can you tell me anything you know in any of those fields with sufficient certainty so that I can cross-examine you over it

meaningfully?

A No.

* * *

Q I show you Exhibit 116, you recognize this as the monthly publication put out by the American Chemical Society which addresses itself to analytical chemistry. You are aware of that publication, aren't you?

A Yes, sir.

Q Well, let's see the first one of those articles. The first one had to do with problems of how you search infrared spectral libraries to identify compounds. That's the general problem there, right?

A I would agree from the title that sounds right.

Q Are you sufficiently familiar with that process and with the logic that underlies it so that one could meaningfully ask questions of you about it?

A No.

Q Well, that's the same sort of infrared spectra we have been looking at, right, that, when we refer to infrared spectra there, that is the same sort of thing that you've been talking about, right?

A I would have to guess, I would guess yes, but I don't know what they mean by infrared.

Q Well, let's take the next one. That one's got something to do with chromatographic analysis as I recall, right? And in fact you used chromatographic integrators in this particular series of experiments that you ran?

A I did.

Q You have any idea what that article is about?

A I don't have the faintest idea what the article is about.

* * *

Q I believe you said that one of the tests that you performed was a test involving cobalt thiocyanate, is that what you said?

A Yes, sir.

Q What I would like you to do is I would like you to do the way we did it in chemistry in high school we are going to take this substance and we are going to add cobalt thiocyanate to it. Well, remember how we used to balance it so that every thing on one side of the equation came out on one side, remember how we used to do that?

A Vaguely.

Q You did that in high school chemistry, didn't you?

A Yes, sir.

Q And all the C's have to balance up and all that sort of thing, remember?

A Again, vaguely.

Q Well, can you give us this and balance it up for us so that we can get some idea of what turns blue and what doesn't?

A No, I can't.

* * *

Q Now chemists are persons who, among other things are familiar with chemical reagents – chemical reactions; isn't that true?

A Yes, sir.

Q And you taught your students in high school chemistry classes how to make chemical reactions balance, didn't you?

A Yes, sir.

Q That is, you taught them that you put the stuff that you added together on one side of the equation separated by a plus sign, and then you drew a little arrow and you got the stuff on the other side that you came out with: Right? And that what you taught in your high school chemistry classes – part of it?

A Yes, sir.

Q And do you know the chemical reaction of cobalt thiocyanate with l-cocaine?

A No, sir.

Q Can you draw that for us?

A No, sir.

* * *

Q And the textbook is a textbook that's used to teach undergraduates how to identify compounds by spectrometric analysis. Do I have that right?

A Yes, I believe so.

Q So let's just pretend we're an undergraduate chemist. Can you tell me what the first compound is? If you don't, the answers are in the book. If you can give me the answer, I will look it up in the book. Can you tell me?

A No, I can't, no.

Q Well, let's go to the next one.

A Just looking at this, no.

Q No, no. This is what the undergraduate has to do for a test. Now look at the next one and tell me. And I will look in the book, see if you get it right. Can you tell me what that compound is?

A Just by looking at it, I cannot tell what this compound is.

Q Well, would that same be true for all of the other

compounds in Exhibit 520? You couldn't tell me what any of them are?

A No.

Q You could not?

A No.

Q Well, didn't you study infrared and mass spectra in college?

A Yes, I did study infrared and mass spectra in college, but I had references with me.

Q Well, didn't they give you tests where you have to look at the spectra?

A Yes, I did take tests, but I had references with me.

Q And your methodology in this case was not to analyze the underlying molecular structure that produced those spectra, but just to eyeball the spectra? Do I have that right?

A No. I had to produce the molecular spectra. In other words, the whole spectra.

Q You eyeballed it. Looked at them with your eyes?

A Yes. Because I know where they are coming from, that's why.

Q That is, if you know the answer in advance, it's not too hard to come up with an opinion. Is that what you're telling us?

A That is correct.

REFUSAL TO PRODUCE UNDERLYING DATA

The spectrometric analysis of controlled substances generates data in the form of infrared and mass spectra. Additionally, the spectrometers are usually equipped with computers which will search their data bases and compare the suspected drug with the hundred of thousands of spectra in the computer's data base.

Government analysts frequently do not supply the prosecution with the digital data underlying the spectra upon which they base their opinions. On occasion even the spectra are not being furnished to the prosecution. In these circumstances bias can be inferred and the cross-examination excerpts which follow may provide a basis for that inference.

Q You compared two spectra and you said that's close enough for me to make an opinion that these things are cocaine, right?

A Right.

Q And if I want to challenge that, and say no they're not close enough, then I'd have to have the spectra, wouldn't I?

A Yes, both the spectra to compare.

Q That is, I have to make the comparison myself. That's one way I could do it, right?

A That is correct.

Q Now, did you submit to the Government, the prosecution in this case, the spectra on which you reached your decisions in this case? Do you understand my question?

A Yes.

Q Did you do so?

A On some of the cases, yes.

Q On the cases about which you testified today, did you submit your spectra to the Government?

A On some of the cases, I did.

Q No. We're going to start again. You examined 18-2. Did you submit the spectra on that?

A I have submitted copies for some cases that I have analyzed to the Government, and I don't remember which one it is. I would have to check up—I don't remember.

Q So you don't know whether you submitted 18-2 to the Government?

A That is correct.

Q You understand if you didn't give 18-2, the spectrum of 18-2 to the Government, that the Government couldn't give it to me.

A That is correct. That is correct.

Q Well, how many infrared spectra did you testify about in this case that you performed?

A I performed infrared spectra.

Q I will bring these back to you. Here is 22-E. Did you perform an infrared spectra analysis on that?

A Yes, I did.

Q Did you give it to the Government?

A No, I did not.

Q So you knew the Government couldn't give it to me, because you didn't give it to the Government. Do I have that right?

A I was not asked to give any copies of my infrared spectrum.

Q The Government never asked you for the copies of your infrared spectra?

A That's correct.

Q So you didn't give it to them?

A That is correct. For this particular one, I did not.

Q I think this is 22-C, but I am not sure. Did you – must be 22-C. Did you submit the spectra on 22-C to the Government?

A No, I did – I don't believe so, no.

Q And then the other one was 18-2. Did you submit the spectra on 18-2 to the Government?

A I don't think so.

Q The Government never asked for these spectra and you never gave it to them—gave that to them, true?

A That's correct.

* * *

Q You, in each of the tests you performed in this case, generated spectra. Do I have that right?

A That's correct.

Q That is, an infrared spectrophotometer generated infrared spectra, right?

A That is correct.

Q And the mass spectrometer generated mass spectra?

A That's correct.

Q Did Mr. Butler [the prosecutor] and his colleagues ask you for copies of those spectra?

A I don't recall, no.

Q You don't recall their doing it? Or they didn't do it?

A I don't believe they did it, no.

Q And if I were—by the way, as I understand what you do is you eyeball the spectra, the Exhibit, and you compare it with the standard. If it's close enough, you say they're the same substance. Do I have that right?

A That's correct.

Q And if I wanted to challenge that, that is if I wanted to claim that you'd made a mistake, I would have to have the spectra that you – that were generated, so that I could do my own comparisons, I guess, right?

A That's correct.

Q And you can see that without having those spectra I am at a certain disadvantage. But it's not your fault. You can see, though, the disadvantage I am at, right?

A Yes.

* * *

Q But as things stand right now either I have to take your word—there is no way I can cross examine you over this particular issue, is there, without having the literature and without having your standard spectra.

A I don't know that there is not anyway, but it is certainly

somewhat limited.

FAILURE TO COMPARE DATA WITH PUBLISHED DATA

The inquiry into general knowledge of scientific principles may be followed by an examination into the refusal of the analyst either to compare his data with data in recognized publications or with data generated by tests performed on the same samples by other government analysts.

Q Well, in particular, the United States Government Drug Enforcement Administration, your very agency, has such a book, doesn't it?

A They have an analytical manual, yes.

Q The analytical manual is a book about an inch-and-a-half thick that has, among other things, in it spectra of various controlled substances, right?

A That is correct, yes.

Q It is a soft-covered book but it is still a book, right?

A Yes.

Q On one of the pages of that book there is an infrared spectrum, isn't there?

A Well, on several pages there are infrared spectra, yes.

Q On one there is an infrared spectrum of heroin-free base, right?

A That is correct.

Q And that book is provided to the chemists in your laboratory, right?

A Not only the chemists in our laboratory but to other forensic chemists, yes.

Q Did you compare the results that you got in this case with the spectrum that is in that book that the Government gives you?

A No, I did not.

* * *

Q I show you Mr. _____, a document. It says on it that it's the Analytical Manual compiled under the direction of John W. Gunn, Jr. Chief Laboratory Division, Bureau of Narcotics and Dangerous Drugs, United States Department of Justice, by Stanley Sobel and Richard Moore. . . . [T]hat would appear to be the analytical manual that you have available to you in your laboratory, wouldn't it?

A Yes, sir.

Q And is there an index to that manual?

A Yes, sir.

Q And if you look in that index do you find a category that says "cocaine"?

A Yes, sir.

Q Would you open the manual to that page and see if it refreshes your recollection concerning whether or not the DEA has provided you with a reference spectrum to cocaine hydrochloride?

A Yes, sir.

Q That is, there is a reference spectrum in the analytical manual provided by the DEA for supposedly authentic cocaine hydrochloride, right?

A Yes, sir.

Q Did you compare the spectrum that you obtained by running Exhibits 1, 2 and 3 through an infrared spectrophotometer? Did you compare those spectra with the spectrum in the manual of the Drug Enforcement Administration?

A No, sir.

* * *

Q Did you look in any book, any chart, any graph, any physics text book, any chemistry text book to see if this data is even close to what it should be for real heroin?

A I compared it to real heroin.

Q I understand. There are people who are not government chemists testifying in court where people are on trial. There are people who write books and who are only interested in the truth and pure science. Did you look up in this book whether your data comes even close?

A I didn't have time to look up in books, and I'm also interested in the truth.

Q How long would it take you, would it have taken you to take a run-of-the-mill college text book in analytic chemistry and looked in the index under B-I-O-T to come up with Biot's Law? How long?

A I don't know.

Q I understand better than you know. We'll try it again. You had never performed the test before in your life on heroin. Right?

A I've done it lots of times on other compounds. Just not on heroin.

Q You've never run it before on heroin. Right?

A That's correct, as far as I can recall.

Q You've never testified in a court about any results that you got using that test on heroin. Right?

A This is the first time.

Q You've never talked to anybody in your laboratory about running it on heroin. Right?

A I did yesterday afternoon for the first time.

* * *

Q Well, let's confine ourselves, since it's not always discussed in the literature in that way, to the literature that is published by the Drug Enforcement Administration of the United States Department of Justice. You are familiar with the manual entitled the Analytical Manual?

A Yes.

Q That manual contains the retention time for authentic amphetamine doesn't it?

A Yes.

Q That manual contains the results which one would obtain under standard conditions using a gas chromatograph that's been properly calibrated; isn't that correct?

A Yes.

Q And do the results that you obtained on this instrument come even close?

A I did not compare it.

* * *

FAILURE TO COMPARE DATA WITH OTHER TEST DATA ON THE SAME SAMPLE

When it appears that some other analyst performed tests on the same substance as the witness and the results of those tests were neither compared with the witness's results nor the prosecutor informed that the other tests had been performed, the inference is created that the witness distrusts his own data and is unwilling to have it compared by the prosecution with data from other government laboratories.

Q And so, if the Government, or any chemist with the Government, had performed additional tests upon that white powder, you would have examined the results of those tests to determine whether your belief was a fair one, whether it was founded upon fact, right –

A No.

Q If other chemists, who were as qualified as you, or more qualified, who were employed by the United States Government, had tested the very materials in this case, you wouldn't have looked at the

results that they obtained?

A No.

Q Sir, let me just ask you the question. Did an employee of the United States Government perform tests on that sample that you have in front of you?

A I don't have any specific knowledge that they did. I assume they did. I sampled it for somebody else to run tests on.

Q Well, when you sampled it for somebody else to run tests, was it your belief that the person that you sampled it for would run the tests?

A Certainly. But I didn't see him do it.

Q When, sir, is the first time that you told Mr. Diskin [the prosecutor] that other tests had probably been run on that substance?

A I don't recall.

Q Did you ever tell it to him?

A I think I did last night. But I'm not sure before that when, if ever.

Q You mean last night was the first time that you mentioned to Mr. Diskin, "Oh-, by the way, it may develop in my cross-examination that we have some other tests that were run." Is that what you said?

A No.

* * *

Q So, the reports and results of the scientific tests that were performed by your laboratory personnel in connection with the signature testing program of the exhibits that you have previously identified would be located either in McLean, Virginia or, perhaps, in headquarters in Washington, is that your best –

A Yes, that is correct.

Q Fine. Did you ever inform the Government, the prosecutors in this case, that the reports and results of such tests were in fact located in some other laboratory and that you didn't have them?

A I don't remember informing them, no.

Q Your best recollection would be that you didn't inform them, right?

A With respect to the – that the graphs were in some other location.

Q Did you inform them that those graphs existed, that there were additional graphs in addition to the ones that you had in your

file?

A There was a discussion as to the fact that heroin signature runs had been made on the portion of the sample.

Q Did you inform the Government that as a result of the signature runs had been made that graphs had been generated reflecting the reports and results of those tests?

A I don't remember specifically that I did say that.

Q Were you asked the question?

A I don't remember that that question was asked.

Q Now, after the signature testing program performed a gas chromatographic analysis of the substances in this case and the graphs about which we are talking were generated, did you compare those graphs – well, did you ever see those graphs, first of all?

A I don't believe I did see those graphs, no.

* * *

Q Did you over the noon hour call your laboratory to find out whether or not, sir, the substances which formed the basis of this trial were subjected the signature testing program?

A Yes, they were.

Q You did call.

A I did call.

Q Did you find out whether they were?

A The report had been written. It was in the case file. Yes.

Q Did you ask them to send it up to you?

A No, I didn't.

Q Did you ask them which tests they performed?

A No. The person who did the test was taking a course.

Q The case file of those test results was in your office. Right?

A That's what I said.

Q There is somebody who took out the file and said "It's here. We have it." Right?

A That's correct.

Q All that was necessary was to open the file and ask the person who took the file out of the filing cabinet what tests had been run. Right?

A That's not correct. It's just a sheet of paper saying what's found. It doesn't have the test on it. There's only one person in the lab that knows all the tests that are run on them.

Q There's one person in the laboratory who knows what test were run on the substance that forms the basis of the prosecution in this case and that person is presently taking a course where? Where?

Where is he taking a course?

A I don't know

* * *

Q Dr. Rieders is a toxicologist?

A He's a very fine toxicologist, yes.

Q Certainly not a man who would try to mislead anyone?

A No.

Q And you recognize that this is a report that the fine Dr. Rieders wrote, and to whom did he address that report, can you tell? To Mr. Roger, Chief Deputy District Attorney. That would be the man seated here on my immediate right, correct? But I'm going to ask you whether you've ever seen that, and whether when you came up with the opinions which you've – which you've voiced in this case, you – you considered the report of Dr. Fredric Rieders?

A I didn't consider this.

Q Did you know that Fredric Rieders had submitted a report to Mr. Roger?

A I did, and I discussed his findings with him, but –

Q Did you ask Dr. Rieders whether he submitted a report, a written report?

A I didn't ask him for a report.

Q Did you ask him whether he submitted one?

A No, I didn't. I assumed he did, but I didn't ask him that question.

Q You assumed he did. So when you arrived in Las Vegas, assuming that Dr. Rieders had written a report and submitted it to the State of Nevada, did you ask Mr. Roger [the prosecutor] whether he'd be kind enough to give you a copy of Dr. Rieders' report and see whether it—whether it corroborated your views; did you do that?

A I talked to Dr. Rieders. I didn't -

Q Did you ask Mr. Roger for a copy of Dr. Rieders' report?

A I don't recall doing that, and I don't recall reading it; he may have sent it to me, but I don't recall reading it.

Q Did you ask Mr. Roger for the report?

A No. And it wouldn't – I'm not gonna change my report to necessarily agree with somebody else.

Q But the answer is, you didn't read the report?

A I don't recall reading it.

FAILURE TO REVIEW RELEVANT RESEARCH

An analyst who deliberately ignores relevant research

concerning his methodology permits an inference that he is concerned that the research will suggest that the methodology is inappropriate.

Q And the FDA, for example, has its own library?

A What do you mean by its own library?

Q You know what a library is.

A Yes.

Q Library is a place where there are books and scientific articles?

A Right.

Q And perhaps even a computer terminal where you can go in and you can look at—for things that have been written like the library at Alexandria, you know what a library is don't you?

A Yes.

Q Do you have a library in the FDA?

A Not in our building, no.

Q The FDA exists in a number of separate buildings, doesn't it?

A That's correct.

Q Does the library exist perhaps in some other building?

A I think it's an HHS library, not an FDA library.

Q There's a library to which you have access.

A Yes.

Q Before you came to Milwaukee to testify about clenbuterol, did you go to the library that's in another building and ask the librarian what does the government have in its files about clenbuterol?

A No, I didn't.

Q Did you go to someone in the FDA and say, look, I'm going to go all the way to Milwaukee and they're going to ask me to testify about clenbuterol, do we have any studies either in the FDA or the Department of Agriculture or the DEA, is there any government agency that's done some research in this area so that I can learn something about it? Did you do that?

A No.

Q Do you have a computer terminal on your desk?

A Yes.

Q Does it go into a data bank that in which research would appear on such drugs as clenbuterol?

A The computer on my desk was changed last week and as of now it goes nowhere.

Q Was there ever a time when that computer could get into a data bank?

A The computer that I had previously was not capable of linking to data banks and that's why we got the new computer.

Q When you knew you were coming to Milwaukee to testify about clenbuterol and you knew that your computer wouldn't get you into a data bank that would have articles about it, did you think perhaps maybe what you ought to do is ask for somebody who had a working computer? Did you do that?

A No, I did not.

Q Is there anybody in the whole United States division of Food and Drug Administration who has got a working computer that can find this stuff, or don't you know?

A I'm sure there is someone in the Food and Drug Administration who has a computer who would search the data if we felt it was necessary to do that.

* * *

Q You arrived in your office yesterday morning and found this document on your desk; is that correct?

A Yes, sir.

Q You don't know who put it there?

A Correct.

Q You don't know where it came from?

A It came from the front office. In our laboratory.

Q Did you discuss it with anyone?

A No, sir.

Q But it appears to have been generated by the Regional Laboratory in Miami, doesn't it?

A It was generated by a Mr. Mark Cunningham in Washington, D.C., and the paper came from the Miami Laboratory: Correct.

Q It is your understanding the work was done in Washington?

A No, it's my understanding the work was done in Miami.

Q And then after glancing at that paper, you realized that that paper concerns itself solely with the problems posed by the stereoisomers of cocaine: Right?

A I believe so, yes.

Q Did you call the Miami Laboratory after you saw that paper to find out whether the research has been completed?

A I didn't have time. I didn't read the paper until last evening. I didn't have a chance.

Q Over the noon hour recess today, did you call the Miami

Laboratory to ask them whether or not the research had been completed?

A No, sir.

Q Did you ask any of your colleagues in the Chicago Laboratory whether there were any later progress reports than the one included with the December 10th letter?

A I don't believe that that would have any relevance, because this is the most recent one. If they had any extra work done, it would have come into the laboratory.

Q Well, it took three weeks or four weeks almost, for the document that's been admitted as Exhibit 9 to mysteriously appear on your desk. Isn't that right?

A Correct.

Q Did you ask anyone whether there had been a subsequent report prepared that answers all the questions?

A When I found this document on my desk there was no one there except myself.

Q You had a telephone available to you this noon, didn't you?

A Correct.

Q Did you call anyone to ask them?

A I just called Chicago this afternoon to report where I was at and what I was doing.

Q Did you call Chicago – when you called – so you called your office: Right?

A Yes.

Q Did you ask anyone in your office whether or not there was a later report from the Miami Research Project?

A No, sir.

* * *

Q Now, you can understand that your – your conclusion concerning your – the reliability of your methodology for identifying drugs as contrasted with the reliability of the algorithmic search of data libraries is a process that probably has been undertaken by others?

A I don't understand your question.

Q Others have also attempted to determine whether or not the technique you use is better than, worse than or equal to algorithmic searches? You would assume that, wouldn't you?

A I guess I'm not willing to make assumptions on things that I don't know to be a fact.

Q Well, let me ask you this. Are you – other than the three

that you ran, are you familiar with any data whatsoever in recognized scientific literature – I'm not talking about conclusions. I'm talking about data. Do you have any data whatsoever in support of your hypothesis that you are more reliable using your methodology than the computer is in identifying controlled substances?

A I do not have any published data of that, no.

Q Other than the three that you have – do you have any unpublished data?

A No, I do not.

Q Other than the three that you have, have you made any attempt to search the literature for data on this subject?

A No, I have not.

* * *

Q No. I am not trying to lead you astray. I really am not. Your hypothesis is based upon the fact there are eight substances in the world that give this spectrum, and that's all of–

A No, I wouldn't say that there is only eight substances in the world that would give that spectrum.

Q You mean there may be something other than the eight diastereoisomers of cocaine that give this spectrum?

A There are other isomers that aren't necessarily diastereoisomers of cocaine. There are other isomers.

Q You mean the structural isomers of cocaine?

A That–yes.

Q But they aren't illegal?

A I don't know all the Statutes. And – I mean, that's not really part of my job or–

Q Well, let's be certain that we understand each other. If there are structural isomers of cocaine, that is structural isomers of cocaine in addition to the diastereo – or optical isomers of cocaine, you're not prepared to give – are you prepared to give your opinion that this is not a structural isomer of cocaine?

A I believe that all the isomers are covered in the statutes.

Q Let's talk–you recognize that there are about 800 isomers of cocaine. That sound about right?

A I have no idea.

Q Have you ever looked at Chem Abstracts?

A Yes.

Q They're pages and pages and pages of isomers of cocaine?

A Okay.

Q That's true, isn't it?

A I've not looked up cocaine in the Chem Abstracts and determined the number of pages that there were.

Q Let's take one of the better known isomers of cocaine. Structural isomers of cocaine. One of the better known isomers is scopolamine, right?

A Correct.

Q Do you know what scopolamine is?

A Yes.

Q What do they use it for?

A Motion sickness.

Q Buy substances containing scopolamine in a drugstore?

A I don't even think that it's on the market anymore. I think that the F.D.A. took that off the market.

Q They used to have patches with scopolamine so that you didn't get air sick. Remember?

A Yes, I do remember that.

Q Can you say to a reasonable degree of scientific certainty that that—the mass spectrum of scopolamine would be different from the mass spectrum of cocaine?

A To be honest, I have not looked at a mass spectrum of scopolamine in several years. I don't recall if—how similar it looks to cocaine.

Q So the answer to my question is you are not prepared to testify—or you cannot testify that the mass spectrum of scopolamine would be different than the mass spectrum you got when you identified the substance in this case?

A Correct.

* * *

Q Are you prepared to say that the infrared spectrum of L-cocaine can be distinguished from the infrared spectrum of alpha-cocaine? That is, have you ever conducted—have you ever measured or used your instrument to measure alpha-cocaine?

A I have not.

Q Do you have any opinion at all based upon your scientific training and experience as to what the infrared spectrum of alpha-cocaine would look like?

A No, I don't

Q Looking at the entire spectrum, can you tell me one difference that the spectrum of alpha-cocaine would have from the spectrum of L-cocaine?

A No, I can't.

Q Can you tell me one point at which those could be distinguished?

A I said no.

Q So as far as you can tell, the infrared spectrum we saw could be L-cocaine, could be alpha-cocaine. We just don't know.

A That's not true.

Q That is, we proceed on the assumption – you assume – without knowing the structure of alpha-cocaine or its infrared – or its infrared spectrum, you assume that it may well be different without knowing what the differences are?

A That's correct.

* * *

Q You know that a company in Germany manufactures clenbuterol, right?

A Yes.

Q Did you make any attempt to search the German literature, that is, to use a literature search with a German data base to see whether or not these relatives of clenbuterol are also manufactured by that company?

A No, I did not. We don't have access to any such data base.

Q Did you call the company and ask the company those questions?

A No, sir.

Q Do you have any reason to believe that if you had called the company and asked those questions the company would have refused to tell you?

A I don't believe so. No.

FAILURE TO PERFORM ACCEPTED TESTS

An analyst who has refused to perform accepted tests permits the inference that, had these tests been conducted, their results would not have supported the opinions of the analyst.

Q And that article has a technique – sets forth a technique for distinguishing cocaine from pseudococaine, isn't that right?

A There is a lot of techniques that it sets forth.

Q There's a very easy one and those are called microcrystalline tests. That's what it says, doesn't it?

A Yes, sir.

Q And you've run thousands of microcrystalline tests in the course of your employment with the DEA, haven't you?

A I don't know thousands. I've run quite a few, yes.

Q And that paper sets forth simple microcrystalline tests that can be run to distinguish cocaine from pseudococaine, isn't that right?

A Yes, sir, it does.

Q And those microcrystalline tests require certain chemical reagents, isn't that right?

A Yes, sir.

Q And you have those reagents available in the laboratory in December, didn't you?

A Yes, sir.

Q But you did not run the microcrystalline tests that are set forth in that paper, did you?

A No, sir.

* * *

Q Have you read or have you looked at any treatise, any scientific tests, any dissertation, any learned scientific paper whatsoever published in any language in the world since 1968 which says that the diastereoisomers of cocaine can be identified by some technique other than nuclear magnetic resonance?

A I don't know of any. I don't recall reading any, no.

Q It is accurate, is it not, that neither you, nor anyone to your knowledge, performed nuclear magnetic resonance analysis on Exhibits 6, 9 and 12?

A That's correct.

* * *

Q And the paper that you just read, the 1968 paper in that journal with the foreign name, that paper says that there is a way – you testified there is a way of distinguishing these things, and that's this device here, Nuclear Magnetic Residence [sic].

A Yes, sir.

Q Did you attempt to secure permission to use Nuclear Magnetic Residence [sic] on Government's Exhibit 1?

A No, sir.

Q Did you send a letter to the McLean Laboratory asking under what circumstances you could submit this material for that analysis?

A No, sir.

Q There are other people in Chicago that have such equipment, aren't there?

A Yes, sir.

Q Did you go to any of the people in Chicago that have such

equipment?

A No, sir.

Q Say "I'd like to test this material."

A No, sir.

Q Have you read or have you looked at any paper, any treatise, any scientific text any dissertation, any learned scientific paper whatsoever published in any language in the world that has been published since 1968 which says that the diastereoisomers of cocaine can be identified by some technique other than Nuclear Magnetic Resonance [sic]: one paper, name an author.

A No, sir.

* * *

Q You have had X-ray diffraction equipment in your laboratory for a substantial period of time; isn't that right?

A Yes, sir.

Q And in December of 1975 and January of 1976 was that X-ray diffraction equipment operating?

A No, sir.

Q Well, was the equipment broken down; is that what the problem was?

A No, sir.

Q Was the problem that there was no one in the laboratory who was trained to know how to use it?

A Yes, sir.

Q And it is accurate, is it not, that neither you nor anyone else performed X-ray diffraction analysis on what has been identified as Government Exhibits 6, 9 and 12?

A Correct.

Q What's the nearest laboratory you know of to Chicago that has this equipment and also has somebody who can make it work?

A United States Customs Lab.

Q In Baltimore?

A No, in Chicago.

* * *

Q Was this equipment calibrated before you ran the tests by someone?

A It was calibrated by a man from the Perkin-Elmer Company.

Q You ran this test in May; is that right?

A Yes, sir.

Q About six months ago: Right? A little over six months ago?

A Yes, sir

Q Now this man from Perkin-Elmer, who came to the laboratory, did he come there in May?

A I don't know, sir.

Q Well did he come there in the previous January?

A He could have been there at any time. I don't take down dates when he comes in.

Q Well, did he come six months before you ran this?

A I can't tell you exactly.

Q Well, did he come a year before it was run?

A He has been there a number of times.

Q And then he came in because the equipment wasn't giving you the right results, and I am now asking you, did the man come from Perkin-Elmer – did the man from Perkin-Elmer come into your laboratory before or after May 10th, 1975; or don't you know?

A I can't tell you.

Q Did he come in before or after May 1st 1975; or don't you know?

A I can't tell you.

Q You ran this test, sir, on May 5th, 1975, didn't you?

A Correct.

Q Do you have any basis at all for telling this jury that the man from Perkin-Elmer came in and fixed this equipment before you ran the test?

A He was there. I don't know when. I have seen him there. I can't tell you when he was there.

* * *

Q How many compounds are there that have peaks at 57, 86 and 262? Do you know?

A I don't know the answer to that, sir.

Q Well, are there more than 100,000?

A I don't know the answer to that, sir. I would be guessing and you've already told me I cannot guess.

Q Well, as we look at the output of a mass spectrometer, if we're good enough we ought to be able to go back and reconstruct what that molecule looks like. True?

A Yes.

Q And so, I ought to be able to, if I were smart enough, and young enough, I ought to be able to look at the mass spectrum that comes out of your instrument and learn probably pretty much all I have to know about that compound. Right?

A I believe it's usually nice to have IR spectrum and also NMR

spectrum in addition.

Q To the best of your knowledge, nuclear magnetic resonance testing was not conducted on any sample in this case. True?

A That's true.

Q You have such an instrument in your laboratory?

A No, we do not.

Q What's the closest one to Cincinnati?

A I believe the University of Cincinnati has several.

Q How far is the University of Cincinnati from your laboratory, approximately?

A A few miles.

Q Do you think if you called them they'd let you use their nuclear magnetic resonance equipment?

A I'm not sure.

Q Do you know how you could find out? You could pick up the phone and call them, right?

A Yes, I believe somebody could have.

* * *

Q That is, you do not attempt – it was my understanding that what you testified to just a moment ago was that if one were to examine all of the visually identifiable peaks and of cocaine hydrochloride and assign a relative intensity to them that no other compound would have precisely the same rank order of spectral peaks with realistically the same intensities, right?

A That's my opinion. That's correct.

Q Have you ever read that that's the case? Do you have any authority that supports that view?

A I'm not aware that that particular method of analysis has ever been performed and, therefore, no, I have never read anything to that effect.

* * *

Q Now, did you in this case, in this case, review the AOAC methods available for testing substances?

A Yes.

Q Did you in fact utilize an approved AOAC method for any of the tests which you performed in this case?

A No, we did not.

Q You were aware of the fact, are you not, that there is an organization called the American Society for Testing and Materials, abbreviated ASTM?

A Yes.

Q It is a recognized organization that sets standards for the scientific and engineering communities. True?

A Yes.

Q Did you review the ASTM standards for any of the instruments that were used in this case?

A Assuming that there are standards that exist for all of the instruments that we used in this case, no, we did not.

Q I'm going to show you 2.19 of the Code of Federal Regulations. You recognize that that's what it is, right?

A That's annotated in the upper right hand corner.

Q Where the method of analysis is not prescribed in a regulation, it is the policy of the Food and Drug Administration and its enforcement programs to utilize the methods of analysis of the Association of Official Analytical Chemists as published in the latest edition and supplements thereto. In the absence of an AOAC method, the commissioner will furnish a copy of the particular method or a reference to the published method that the Food and Drug Administration will use in its enforcement program. Did the commissioner furnish you with the methods you were supposed to use?

A No, the Commissioner did not.

Q Now, you do have something called the laboratory procedures manual. True?

A That's true.

Q Do you recognize Exhibit 894 and 898 as being portions of that manual? Is that true?

A Yes.

Q Is it your position that when you are doing your forensic work and you have your forensic hat on, that you are not bound by the provisions of this manual, or are you bound by it?

A We are not bound – we have some flexibility.

Q Is it your belief that you are not bound by this manual when you have your forensic hat on?

A Certain portions of the manual apply.

Q When you do your regulatory work you are bound by the manual?

A We try to follow the established procedures, yes.

Q When you do your regulatory work you're bound by the manual; when you do forensic work you feel that there are areas where you're not bound by the manual. Do I have that right?

A That's correct.

Q What is your source for your position that when you were doing forensic work that you were not bound by the Laboratory Procedures Manual of the Food and Drug Administration?

A The Laboratory Procedures Manual does not apply in all instances.

Q Where do you find the authority for that statement that it doesn't apply when you're doing forensic work?

A There's a whole different system that has had to be established for the Office of Criminal Investigations.

Q Where do you find authority for the proposition that the Office of Criminal Investigations doesn't have to follow the Laboratory Procedures Manual of the Food and Drug Administration when it analyzes substances? Where?

A I don't know where the authority comes from.

Q You just assume it exists somewhere.

A I assume it exists somewhere.

* * *

Q Do you know what I mean by matrix?

A Yes, I do.

Q That is, the example that was given sometime before was the needle in the haystack; the needle is the analyte, the haystack is the matrix. Right?

A Correct.

Q Or if we're looking for sugar in sand, the sugar is the analyte and the sand is the matrix. Correct?

A Correct.

Q And in this case we're looking for the presence or absence of clenbuterol in a matrix of a heterogeneous matrix of animal feed. Right?

A Correct.

Q Well, you certainly have heard that instrumental analyses are more accurate if the precise matrix is employed for matrix blanks.

A Correct, that's the ideal situation, and when you have that situation we do that.

Q When you realized that you didn't have the matrix, did you call the U.S. Attorney in this district and say can you get us a blank matrix?

A No, I did not.

Q You do know Dr. _____, don't you?

A Yes, I do.

Q He's the head of the branch of the laboratory at which you

work?

A Yes.

Q Did you go to Dr. _____ and say would you contact the people and see if you can get me the matrix?

A No, I did not.

Q One of the things, if I sent you a matrix and you didn't trust me, one of the things you could do would be to examine the matrix and see if they looked the same. Right?

A That would be correct.

Q And if they looked the same then maybe that gave you some basis to trust me. Right?

A That would be correct.

Q Do you have a telephone in that laboratory?

A Yes, I do.

Q Do they let you make long distance calls all the way to Milwaukee?

A Yes, they do.

Q Did you do it?

A No, sir.

* * *

Q This Fourier transform infrared spectrophotometer that you've got in your laboratory has a computer associated with it, doesn't it?

A Yes, there is.

Q And the computer has a data base, doesn't it?

A Yes, there is.

Q And the data base of that computer contains thousands and thousands and thousands of infrared spectra?

A That's correct.

Q And if what you wanted to do was you wanted to compare the spectrum of 18-2 or 22-C or 22-E with the spectra in the library, in the data base of that computer, all you would need to do would be to push a button on the computer and then the computer would tell you what is the probability that the substance you have tested is cocaine. That's how it works, doesn't it?

A It gives a match value number.

Q The computer will compare the spectrum of the stuff you tested 18-2, 22-C, 22-E, against all the thousands of spectra in its library, and it will say this one fits best, and this one fits second best, and this one fits third best, and all the way down to the first ten. Do I have that right?

A Yes. That's why it's called a match value number.

Q And it will put alongside of the first match that is the most probable, and the second match, and so on. It will put a number telling you what is the probability of the fit. How good the fit is?

A I don't believe it's a probability. It is a number, I believe, that it's calculated, and it gives the best number and the least number that is--is the best--the best match, and it -- the decreasing differences decrease in the number down at the bottom, so the top number would be the top match.

Q So if I push the button, if I put 18-2, for example, into the infrared spectrophotometer and I push the button, what it will do is it will match it against--it will attempt to match it against all of the thousands of spectra in its data base or spectra library, and then it will give me a list of the ten most probable compounds that match, right?

A Yes.

Q And how long does it take the computer to do that?

A Not very long.

Q How long?

A Probably two seconds or three seconds or less or approximately -- let's go a minute or less than that.

Q And so when you attempted to identify the substance in this case, and you had a computer available to assist you in this process, you pushed the button so you could see whether or not your judgment was the same as the decision of the computer. Did you do that?

A No, I did not. Not in all the cases.

Q Is there also a computer attached to the mass spectrometer?

A Yes, there is.

Q And in the data base of the mass spectrometer there are thousands and thousands and thousands of mass spectra. Do I have that right?

A That's right. That's correct.

Q And what the mass spectrometer's computer does is about the same, what the infrared spectrophotometer's computer does. That is, it takes the mass spectrum of the unknown compound, and it matches it or attempts to match it with one of the thousands of spectra in its data base, true?

A That is correct.

Q And let's go back to the infrared spectrum. You do know that that infrared spectrophotometer has cocaine. That is, has a spectrum of cocaine, authentic cocaine, in its data base. You know that, don't you?

A Yes, there is.

Q And the mass spectrometer also has the mass spectra of cocaine in its data base, true?

A Yes, that is correct.

Q And so what you did when you attempted to match the mass spectra of the unknown substance of this case, that is 22-C and "E" and 18-2, what you did is you pushed the button on that computer on the mass spectrometer to ask the mass spectrometer to see whether it had the same judgment you did. Do I have that right?

A No.

Q And how long does it take the mass spectrometer to scan its spectral library?

A Couple of seconds.

* * *

Q Do your instruments—that is, the infrared and mass spectrometer, do those instruments in your laboratory have computers associated with them?

A Yes, they do.

Q Each of them has a computer?

A Yes.

Q Each of the computers has a data base in which appear thousands and thousands and thousands of spectra, right?

A That's correct.

Q Also in each of those computers contains at least five algorithms, right?

A I am not certain of the number, but I know they have algorithms.

Q And if you wished to do so, you could instruct the computer to compare the infrared – infrared spectra in one case or the mass spectra in the other case with the infrared and mass spectra of Exhibit 2.1, right?

A Yes.

Q And approximately how long after you push the button to instruct the computer to perform this exercise will it be before the computer prints out its results?

A It's very rapid. Probably three to five seconds.

Q And when the results come out, it rank orders from one to ten those compounds whose spectra are closest in fit to the spectrum of the unknown substance. Do I have that right?

A The ten of the most – the close – that closely fit in their library, yes.

Q Of the thousands and thousands of compounds in their library, the ten that are closest fit and those are rank ordered?

A Yes, they are.

Q That is, the best fit is listed first, then the second best fit is listed second, and then so on, right?

A That's correct.

Q And then somewhere among those ten, if we ran that, would be cocaine. We would hope so, at least?

A Most probably, yes.

Q But then you would have a computer printout that you could bring to me and to the jury and say the computer didn't eyeball it. What the computer did was attempt to match it against thousands of compounds, right?

A That's correct.

Q Mr. _____ [the witness], do you know the story of John Henry?

A I—yes, I seem to remember.

* * *

Q Tell me, sir, is there any place where the instrument and the column are the same – is this one unique to Mr. _____ [the witness]?

A It is unique and that is why we –

Q So why don't we call this [the witness's] method?

A If you prefer, sir.

Q You've looked at books that have retention times in them for systems other than [the witness's] method. Right?

A Yes, sir.

Q They don't give ranges; they give numbers. True?

A True.

Q Under [the witness's] method we give ranges, under everybody else's method we give – well, under the books' methods we give numbers. Do I have that right?

A That's correct, sir.

* * *

Q Now – now, putting aside my disadvantage, are you familiar with a testing program of the United States Government Laboratories called the Signature Testing Program?

A I am aware of specific signature programs. A generalized signature program I am not aware of.

Q Let's confine ourselves to a signature testing program for cocaine. There is one, isn't there?

A Yes, there is.

Q And the signature testing program is a series of—well, first of all, were samples of Exhibit 12-E and 2-1 submitted under the signature testing program?

A I don't believe so.

Q Well, let's tell the jury what it is. There are very skilled analysts, chemists who work for the Government in a laboratory in—where is it? In Virginia?

Q Is it Langley? Where is that in Virginia?

A I believe it's McClain, Virginia.

Q McClain. I am sorry. And there are some very bright, skilled chemists there. You know that, don't you?

A Yes.

Q Probably the best chemists the D.E.A. has?

A I would say some of them are, yes.

Q And under some circumstances a chemist in your laboratory will send samples such as we have in this case off to those people, those chemists at McClain, Virginia, for additional testing, true?

A That is correct.

Q And who in your laboratory makes the decision whether or not to send samples off to the lab under the signature testing program?

A It's a lab-wide policy.

Q And there is a lab-wide policy that says certain samples will be sent and certain won't?

A Yes.

Q And is it based upon the amount?

A Yes, it is.

Q And five kilos is not enough?

A No, it is not.

Q But if it's an important case involving hundreds or thousands of kilos, then it is. Do I have that right?

A Ten kilograms or more.

Q Anything over ten kilos goes to McClain, Virginia, right?

A That is correct.

FAILURE TO REVIEW PRIOR ERRORS

Similarly, when the analyst acknowledges that recent research requires that certain tests must be performed to identify a controlled substance, the failure of the analyst to review prior prosecutions in which these tests were not performed suggests that the analyst may be

unconcerned about convicting innocent defendants.

For example, at one time the law of Wisconsin criminalized only l-cocaine, the left handed stereoisomer of cocaine. Its enantiomer, the right handed stereoisomer, d-cocaine, was not controlled. When this issue was raised in state and federal prosecutions, laboratories were instructed to test suspected cocaine with a polarimeter to distinguish between these stereoisomers. The following inquiry explored this development.

Q My question is, does your search for the truth require that, when you were told about instrumental techniques that are now required, that does not require you to go back and apply those techniques to those that have been previously concluded. True?

A I did not feel it necessary to go back on any previous cases that I had examined because I believed at that time—and I still do—that all of the cocaine samples that I identified were chemically equivalent to a derivative of cocoa leaves.

Q You understand that in a court of law, you don't testify to your beliefs. You testify to your findings and to your conclusions thereon, right?

A I testify to my opinions.

Q And, ma'am, there were no findings. You never discussed d and l-cocaine in any of the cases before you were required to use a polarimeter, did you?

A I don't know what you mean by we never discussed d and l-cocaine.

Q In a court of law when you stood up, took an oath and somebody asked you what is that substance, you said it was cocaine, right?

A If it was cocaine, yes.

Q And prior to being ordered to utilize a polarimeter and testify as to whether it was d or l-cocaine, you never testified as to whether it was d or l-cocaine, did you?

A That's correct.

Q And so at no time did you feel that it was necessary to go back and revisit those earlier conclusions in which you had not specified which isomer it was, true?

A That's correct.

Q And you didn't do that because you believed that is—you believed it was unnecessary, right?

A That's correct.

Q Did you go to the head of the laboratory and say, "Look, in substance I believe that everybody in whose case I testified, I believe

they were guilty. But now that we are supposed to be running a polarimetry test, should we go back and retest those substances?" Did you say that to the head of your laboratory?

A No, I did not.

Q Did you say it to the Attorney General?

A No, I did not.

Q By the Attorney General, I don't mean the Attorney General himself, but the person who runs the laboratories of the State here. Did you go to him and say what should I do about this, or I'm troubled by this or I don't know what to do? Did you do that?

A No, I did not.

Q Were any memoranda or any documents internally circulated which addressed the question of whether or not those earlier cases in which polarimetry had not been run, whether those cases should be reopened?

A Not to my knowledge.

THE SUBJECTIVITY OF THE METHODOLOGY

And finally the inquiry addresses the subjectivity of the methodology. The inquiry is only meaningful if the prior responses are viewed by the jury as implausible and suspicious. The syllogism is that a witness who gives implausible responses is either inexperienced, uneducated, or biased and that his subjective judgments are not to be trusted.

Q Well, you told us earlier when [the prosecutor] talked to you briefly, that what you did is you looked at a mass spectrum that you generated on sample 2408, and then you compared it with a standard, you recall saying that?

A Yes, I do.

Q That means you look at one and you look at the other and you come to some judgment whether they are the same, right?

A That is correct.

Q We are talking now if you know anything about the analysis of the spectra, mass spectra, other than what I just described?

A No, I don't.

* * *

Q By "essentially the same", you mean what you consider to be important will be there. Right?

A That's correct.

Q Now, when you say that the differences [between spectra] are insignificant, you have a basis for that, don't you?

A Yes.

Q You said you weren't an expert in the theory of this [instrument].

A That's correct.

Q So you must have read somewhere that some differences are important and some differences aren't. Is that true?

A No. It's based on experience.

Q Well, somewhere there is something that's written by somebody who knows something about this who says certain differences you can overlook and certain differences are critical.

A No. I have never read any such thing.

* * *

Q There comes a point, does there not, Mr. _____, where the differences are so great that you don't look at the jury and say, "I know it's heroin, I know it's heroin, I know it's heroin." There's got to be some point where the differences are great enough where you say, "Okay, they don't match up." Right?

A Yes.

Q How much?

A I cannot give you a definite answer. It's based on experience.

Q That's what we're basing it on, your experience?

A That's correct.

Q Right now, I'm going to ask you: Based upon your experience, if it's twice as much as 37 and it's off that much, are they different compounds or the same, or don't you know?

A I cannot tell you. I cannot give you an exact answer.

Q Give me an approximate answer. If it's 70 percent off?

A I will not play that game. I can't have an exact number for you.

Q Let's just get ourselves organized here. Excuse me, Mr. _____. This is not a game you're playing. What you're doing is you're trying to explain to this jury what the scientific method is all about, and we're going to try it once more. There does come a point, does there not, when your opinion would be that they are not the same substances.

A I've already said that.

Q And now I'm going to ask you: Give me a figure of merit.

A I cannot give you a figure.

* * *

Q So now if you had plotted the various peaks that you

obtained, you would indeed get a Gaussian [sic] curve, wouldn't you?

A Well, you'd get many. You'd get one for each peak.

Q Yes. What we'll do is we'll plot first at peak, say, at 1740 and we'll plot that peak, and then we'll take the next peak and we'll just plot the peaks. Right?

A One could do that, yes.

Q Yes. And then after one did that, one would then get a—Actually—I apologize—it should be a little further out and the band goes through what are called, well, the inflection points of a curve. And there is a distance between the dotted line and that distance has a name that's related to the reliability of your tests. Do you know what that distance is called?

A I believe you're talking about standard curve. I've forgotten the word now.

Q Forgot the word?

A Standard deviation, I believe, is what you're talking about.

Q And that has the symbol sigma. Right?

A Yes.

Q And if you knew the standard deviation, then you could answer some of the questions. Right?

A If one would want to do all that work, yes, one could do that.

Q But to put it in the passive voice, one didn't do that work, did one?

A I did not do it.

Q You do know, do you not, that once you have sigma, the standard deviation, then you can calculate what's known as the standard error by the mean? You know that, don't you?

A Something about it. It's been a long time since I had statistics like this.

Q And unless you calculate the standard deviation, you cannot calculate that error, can you?

A Well, as I understand it, it's more like a confidence, understanding how well your confidence limits are in your data.

* * *

Q That is, some analysts conclude the substances are the same, some conclude they are different, some conclude that it's wrong; is that right?

A At that point the analysts may come to that conclusion based on their experience and their training.

Q That is, some come to one conclusion, some come to the

other conclusion, some come to no conclusion at all. Do I have that correct?

A Might be a possibility, yes.

* * *

Q You basically compare the infrared spectrum of the unknown compound, that is the stuff in the bag, against the spectrum of what you believe to be a known compound, and then if it's close enough, you say that these compounds are the same. And that that one's cocaine. Do I have that right?

A That's correct.

Q And you do the same thing with an infrared—or with a mass spectrum. It's basically an eyeballing process and a visual comparison, true?

A That would be true.

Q And it would be your—let me read some things to you and see if you agree. Would you agree with the following statement by Dr. Michael Camp, who is head of our laboratory here: When an analyst attempts to determine whether the differences between two spectra are significant, he relies upon his training, experience, and the analyst develops a feeling for it. Do you agree or disagree?

A I would say that's for the most part true. It's a little more than a feeling.

Q And he was then asked the following series of questions: That is, some analysts conclude the substances are the same, some conclude it's different, some conclude it's wrong, is that right? Answer: At that point the analyst may come to that conclusion based on their experience and their training. Question: That is, some come to one conclusion, some come to the other conclusion, some may come to no conclusion at all. Do I have that correct? Answer: Might be a possibility, yes. You agree with that?

A I would say if the differences are different enough or similar enough, that most or all analysts would say that it would be true.

Q And when I asked him how different must spectra be, that if—we're talking about infrared spectra at this point—in order for you to conclude that they are not the same substance? His answer was: I can't give an answer to that particular question. Would that also be your answer?

A That would be true. There is no numerical value.

Q That is, it's impossible to quantify. It's a judgment call, right?

A It's a little more than a judgment call, but that's a pretty decent assessment.

Q And similarly, if I asked you how similar must two spectra be in order for you to conclude it's the same substance, that's really the flip side of the other question. And the answer is that's something that can't be quantified. It's a judgment call. Fair enough?

A It's something we learn through experience and training, yes.

* * *

Q What you do with that spectra is that you compare one with another one and you make a judgment call about whether it is close enough for your purposes, right?

A It is a comparison of a sample with an authenticated standard, yes.

Q You then make a judgment call whether it is close enough?

A Yes.

Q And people who are better in this field than you are, they make better judgment calls, right?

A Well, let's hope that they would, yes.

Q And people who aren't as good as you are, they make worse judgment calls?

A Yes, I would assume that would be correct.

* * *

Q Well, you told us earlier when Mr. Cubbie [the prosecutor] talked to you briefly, that what you did is you looked at a mass spectrum that you generated on sample 2408, and then you compared it with a standard, you call [sic] saying that?

A Yes, I do.

Q That means you look at one and you look at the other and you come to some judgment whether they are the same, right?

A That is correct.

Q You know anything at all about the analysis of mass spectrum other than this process of looking at one and looking at another and saying they look the same? Anything at all?

A I know basically how a mass spectrometer works.

Q We are talking now if you know anything about the analysis of the spectra, mass spectra, other than what I just described?

A No, I don't.

* * *

Q But they do not exactly match. You have to determine if the differences are significant, right?

A Yes.

Q So, again, it is a judgment call as to whether these are

significant differences, right?

A Yes.

Q As things stand now, it is your position that the difference between the spectra that you ran on the standard and the literature were not significant differences, right?

A That is my opinion.

Q You are not disputing the fact that somebody else could make the same comparison and might come up with a different conclusion?

A No, sir.

* * *

Q Well, each one you've been doing so far is you've been measuring the distance from the base line. Right?

A Well, the problem is to determine what [is] the peak; whether that's a peak or this is a peak. This is definitely a peak. It's just whether the shoulder here or the bump is a peak.

Q You mean the whole thing is kind of iffy?

A In this area, yes. But it's iffy depending what you want to call—your definition of what a peak is.

Q Well, when you read your chart, that is, the one that you prepared, what definition did you use? Let's try to use the same definition right along.

A There is no real definition is what I'm telling you. Everybody's got their own idea of what a peak is. Everyone's got their own idea.

Q Did you use a system by anybody other than [the witness's] system?

A No. I used my own.

Q It's your testimony that you cannot compare a mass spec with the literature. Is that right?

A Not with any accuracy you can't.

Q Sir, that's your understanding. Right?

A You cannot do it with any accuracy.

Q That is, certainly a person who had a mass spec and counted the mass numbers along the chart and then compared it with the literature would not, in your professional opinion, be performing a proper analysis using a mass spec. Is that right?

A If that's what he was using to identify it, that's certainly true.

Q And whether he wrote the book on mass spectrometry, that wouldn't make any difference?

A Not the slightest.

Q You can't compare the mass spec with literature values.

A I didn't say that. I said you can't make an accurate determination.

Q You don't consider yourself an expert on mass spec, do you?

A I know something about it.

Q Do you consider yourself an expert in it?

A As far as the courtroom is concerned, yes.

Q You're a courtroom expert in the mass spec.

A That's true.

* * *

Q Your conclusions are based on certain assumptions?

A That is correct.

Q If the assumptions are wrong, then the conclusions are wrong?

A If the conclusions are based on those assumptions, the conclusions may be right with the assumptions being wrong. It is true that my conclusion rests on my assumptions. I mean, change an assumption, we get different conclusions.

Q Remember the IQ tests we used to take in grade school?

A Yes, yes, yes.

Q So when they gave you the values 1, 2, 3, they then ask you in the test what are the next two numbers in the series. Remember that test?

A Sure.

Q What is the correct answer?

A If the first are 1, 2, 3, the correct answer would be 4, 5 for the next two.

Q All right, then you could just draw a straight line, couldn't you? That becomes a straight line, doesn't it, more or less? That is called a linear progression, right?

A A straight line is called linear, right.

Q Let's take our number series just like we did in the test. 1, 2, 3. If it is primes, what is the next number?

A 5 and 7.

Q If it is last two digit sums, what is the next number?

A Last two digits, 5 and 8.

Q What we are doing is we are showing different ways of projecting from the same three numbers, right, using different hypotheses?

A All right.

Q There is a general formulation for what we have just done,

isn't there? You know number theory, don't you?

A Some.

Q How about this one? Through any finite number of points an infinite number of lines can be drawn. Do you remember that? That is true, isn't it?

A That is true.

Q How many lines can be drawn through three points? An infinite number, right?

A Right.

Q How many through four?

A An infinite number.

Q How many through six?

A An infinite number.

* * *

Q How different must they [infrared spectra] be in order for you to conclude that they aren't the same substance, or can't you answer that question?

A I cannot give an answer to that particular question.

Q How similar must two spectra be in order for you to opine that they're spectra of the same compound, or can't you answer that either?

A My comparison is based on my experience, and I cannot give you how similar or how different.

* * *

Q Can you think of any treatise . . . which will describe for us the process by which an analyst visually compares two spectra and which identifies what differences are sufficiently important to warrant the conclusion that the substances are different and what similarities are required to warrant that the substances are the same?

A I'm not familiar with such a treatise.

* * *

Q Do you know of any treatise at all, any book, that tells you how far off these spectra can be and still be spectrum of cocaine?

A No, sir, I don't believe there is a treatise written.

* * *

Q Are you able to describe for us in mathematical terms or in any quantifiable terms how close two spectra must be in order for you to reach that judgment [that the substances are the same]?

A I can do that by asking a question back. How—how would two faces—how much would two faces have to differ to make one—make sure that you were dealing with one person or two people?

Q That means that there is no way just as there would be no way of quantifying how close two faces must be in order to warrant the opinion that they are the faces of the same person, so you are unable to give us any quantification of the basis for your judgment that two spectra are sufficiently similar to warrant that opinion?

A The only basis I can give you is my knowledge, experience and analytical abilities.

* * *

Q You are familiar with the fact that there are published volumes of infrared spectra containing thousands of spectra, right?

A Yes, sir.

Q Of the thousands of spectra contained, you perhaps have compared the infrared spectra of cocaine with a couple of hundred, right?

A Several hundred.

Q You have compared the infrared spectrum of cocaine with several hundred spectra and have concluded that it is sufficiently different so that you can recognize the difference, true?

A True.

Q But of the remaining one million or so organic compounds you must hypothesize—That is, you must assume that the spectra of those compounds will also be sufficiently different from cocaine so that you could reach a decision so that you could distinguish the spectrum of cocaine from them, right?

A That's correct.

Q One of the bases upon which you conclude that the infrared spectrum of cocaine will be different from the spectra of the million compounds that are out there is that you have compared it with the spectrum of about 200 compounds, right?

A That's correct.

Q When you compare the spectrum of cocaine with the spectra of these other compounds, you have concluded that the spectrum of cocaine is sufficiently different from the other spectra so that you can distinguish cocaine from these other compounds based upon the infrared spectra, right?

A That's correct.

Q Now, you also conclude that you can distinguish cocaine from the infrared spectra of the million compounds that are out there that you haven't seen the infrared spectrum of, right?

A That's correct.

Q And you do that on the basis of the fact that you believe that the difference between the spectrum of cocaine and the spectra

of these compounds that you've never seen would also be sufficiently different so that you could identify cocaine, right?

A That's correct.

Q And your conclusion that the spectrum of these other compounds would be sufficiently different from that of cocaine to permit you to make that conclusion is based upon the two pages in Suzuki, true?

A That's one of the bases.

* * *

Q Now, you have had some statistics in college, have you not?

A A small amount, yes.

Q But you are familiar with a concept of confidence limits in analyzing and reporting data?

A Yes.

Q And the lower the confidence limit, that is, if you say that you have something at a 10 percent confidence level, you are less certain of it than if you had said, say, a five percent confidence level, right?

A Okay.

Q And the reason that people in this field, the field of science, express data in terms of confidence levels is so that they can communicate to each other how sure they are of their conclusions, right?

A That would be correct, yes.

Q And there is a means of analyzing large quantities of data so that this expression for confidence limits can be mathematically determined, right?

A Yes, sir.

Q And the reason that there is a mathematical way of doing it is so that you do not ask a chemist, "Well, what is your conclusion, sir"? And he says, "Well I conclude it is heroin." And you say, "Well, is it better than a guess and less than a hunch or more than a hunch and less than a pretty good idea?" It is a way of placing a number—of evaluating the sureness that a person has of his opinions, right?

A Yes.

Q And did you calculate the confidence levels of the conclusions that you stated in this court?

A That is really not enough conclusions there. As you mentioned before, you have to take a large sample in order to come up with something that is representative.

Q So the way you would have to do it, if you were interested in

communicating to this jury how certain you are in a mathematical sense; that is, whether it is better than a hunch and less than a guess or whether it is 85 percent or 95 percent or 99.9 percent, you would have to take the data that you have run before, that is the charts that you have run before in your career and you would have to prepare a statistical analysis of it so that you could then tell us that the results that you obtained in this case were valid at the 95 percent level or whatever level it was, right?

A For a statistical treatise, I would say, yes.

Q But for any statistical submission, for any way of assessing the confidence level of this data, you would have to rely on this data and data that you had previously obtained, right?

A I don't, and for this instance, could not rely on previous data of other exhibits to discuss whether or not I was confident that this exhibit—the analysis that I did on this exhibit was, in fact, to use your terminology, better than a hunch, a guess or whatever.

Q Then you could come in here and tell us the confidence limits or the data because you could prepare the kind of statistical study that we have been talking about, right?

A For any statistical representation, yes.

* * *

Q Now, are you familiar with the National Bureau of Standards?

A I have heard of them.

Q Have you read any of their materials concerning precision measurements and how people should go about doing precision measurements?

A Not that I can recall.

Q Have you ever read anything about precision measurements from any source?

A Probably in college. We had to know something about measurements and precision. But I have read nothing since then.

Q Well, you know that when you compare two things—any two things—and you reach an opinion that they were the same or that they were different, that then if you are engaged in a scientific inquiry, you attach confidence limited to that opinion. Do I have that correct?

A I don't know that.

Q Do you know what confidence limits are?

A Not specifically, no.

Q Do you know approximately what confidence limits are?

A No, I do not.

Q Do you know what's meant by confidence?

A In a lay sense, yes.

Q That is in a lay sense it means sort of strength of belief, right?

A I will agree with that.

Q And as you engage in a scientific inquiry, scientists assign a mathematical term or a mathematical quantity to the strength of their belief in a hypothesis. You understand that, don't you?

A They can based on multiple measurements.

Q And when you conclude that some substance is cocaine do you assign some sort of number to that so that we can tell how strongly you believe that?

A I do not assign a number to that, no.

* * *

Q Let us consider the process. What you do when you look at two spectra and you attempt to determine whether the differences between them are because they are different compounds or whether the differences between them are for what you would call artifacts of the—of the testing protocol, true?

A Or whether—in some respects that's true but it's not complete. Differences between them could be due to other—other components present in the sample also.

Q If, for example, I had a sensitive beam balance scale and I were to weigh his ball point pen on a very sensitive beam balance scale that weighs things to micrograms, if I did it twice, I'd get two different numbers, wouldn't I?

A You possibly could. You possibly might not.

Q If I did it one hundred times, the range of values that I get would be what is called normally distributed, true?

A I don't know that. I'm not familiar with normally distributed.

Q If you do a large number of physical measurements of the same variable, you will get what is called a bell-shaped curve? You're familiar with that?

A Yes, I am.

Q Are you also aware of the fact that the technical name for a bell-shaped curve is a normal distribution?

A Yes, sir.

Q So, if, in fact, I weigh this pencil on a sensitive scale, I will get a bell-shaped curve? My measurement will follow a bell-shaped curve, right?

A That's correct. They should.

* * *

Q You are familiar in general with the work of a man whose name was Heisenberg; Werner Heisenberg, and you are in general familiar with what he did for a living, right?

A Some of what he did, yes.

Q He was a recognized scientist, wasn't he?

A Yes.

Q He said in one of his treatises for which he got a Nobel Prize that there is a certain uncertainty that attaches to all physical measurements. You recall what is referred to as his "uncertainty principle," don't you?

A Yes.

Q If you were a skilled enough mathematician you could attach an uncertainty to the measurements which you made in this case, couldn't you?

A Yes, I believe that is true.

Q But you are not able to do so because that is really not your field, right?

A That is correct, yes.

* * *

Q How high must the correlation coefficient generated by that computer be in order for you to accept the hypothesis that the substances are the same?

A That has not been established. We don't rely solely on the library search and match.

Q I am asking you, how high does the correlation coefficient have to be for you to say it's a match?

A We don't have any established number.

* * *

The Wisconsin statute criminalizes the possession of tetrahydrocannabinol. The prosecution's analyst identified that this substance was present on the leaves of plants found in the defendant's briefcase. His identification was based on a computer printout generated by a mass spectrometer that compared the mass spectrum of the suspected THC against thousands of spectra in its spectral database. The computer calculated and printed two match probabilities shown as C1 and C4.

The defendant in his case called a Ph.D. chemist familiar with the computer program who testified that a C4 match probability merely showed the probability that the suspected THC was a member

of a class of substances similar to THC, while the Class C1 match probability reflected the computer's calculation of the probability that the suspected substance actually was THC.

Q And you—You put that data into the computer, and the computer tries to match that data with data in the database of the computer, the spectral database of the computer, and tell you what's the best match, do I have that right?

A I don't physically put the data in. This is the data that the computer generate from the spectra.

Q This data is generated from the mass spectrometer?

A Right.

Q And, what is searched in your computer is that data, right?

A Correct.

Q So now let's, first of all, ask the question, what spectral libraries are in your computer?

A We search based on three libraries.

Q The first library is generated by the Wisconsin Department of Justice State Crime Laboratory, right?

A Correct.

Q Whose other libraries do you use?

A Our second library is the NIST Library.

Q Yes. And the third?

A Is Wiley.

Q The Wiley Library has THC in it, doesn't it?

A I'm not quite sure.

Q And the NIST Library has THC?

A Yes.

Q And the Wisconsin Crime Laboratory Library has many copies of various THC's in it, right?

A It has THC, yes.

Q It has many spectra of THC in that one library alone?

A I believe it may have a couple.

Q Not only has a couple, it has about fifteen of them, doesn't it?

A I do not think so.

Q Well, what do you think is the number of spectra of THC in your entire data base? Wiley Library? Everything?

A I'd be making a guess if I . . .

Q Isn't that important?

A No.

Q By the way, did you study in college mathematics?

A I had to take mathematic courses.

Q Ever take any course in Probability Theory?

A No.

Q I'm going to show you a demonstration that that a college professor does in Probability Theory. Let's assume that the Queen of Clubs is THC.

A Okay.

Q Well—Let's see what happens. I put out, I think, eight cards. Now, let's look for THC. And this isn't a card trick; that is what they teach you in Probability Theory classes. Let's push them over; six of Clubs. Queen of Clubs. We got THC once, right?

A Correct.

Q Queen of Clubs. We got it again. Right?

A Correct.

Q Queen of Clubs a third time. Right?

A Correct.

Q And a 4th time.

THE COURT: What kind of deck of cards do you have there?

MR. SHELLLOW: The same kind as his spectral library; a stacked deck.

Q Now, that deck of cards comes out that way, and here, so that the jury can see—because there are 24 Queen of Clubs in the deck. And the more you load up, you know what a card dealer calls a deck that's not straight, he calls it a stacked deck, doesn't he?

A I don't know.

Q You never heard the expression stacked deck?

A No.

Q Well, you can see how the number of Queen of Clubs in the deck affects the probability of drawing one, can't you?

A Yes.

Q And, now I'm going to ask you again, the number of times that THC is in your spectral libraries affects the probability figure, doesn't it, or, don't you know?

A I don't know.

Q Did you tell the District Attorney that your spectral library had more than one copy of THC?

A No.

Q Wouldn't that have been fair?

A I don't know.

Q Now, let's look at your data. The record should reflect I'm putting Exhibit 1 on ELMO. Well, we see the first three there are

tetrahydrocannabinol, right?

A Correct.

Q Well, how many libraries are they in?

A They are in one.

Q You mean you have got three THC's in just one library?

A Yes.

Q Which library is that?

A The one that is generated at the State Crime Lab.

Q We'll call that the police library from the Wisconsin Department of Justice, right?

A Yes.

Q Did you tell Mr. Moustakis that the Wisconsin Department of Justice Spectral Library that you used was stacked?

Q Did you?

A I don't believe it's stacked.

Q We understand. You work for the Wisconsin Department of Justice, don't you?

A Yes, I do.

* * *

Q Now, let's talk about some other things. The program that generates this particular computer printout that we're looking for is what's called the Probability Matching Program, PBM, right?

A Correct.

Q Now, have you read the instruction manual that goes with the computer that's attached to your mass spectrometer.

A Can you rephrase that question?

Q Sure. Your mass spectrometer has this computer built into it, right?

A The program?

Q The computer the hardware's built in?

A Correct.

Q And the computer is made by whom?

A I'm not quite sure. I think it's Hewlett-Packard. I'm not sure.

Q And Hewlett-Packard has a manual that tells you what all of this means, right?

A Correct.

Q You have read it?

A I've looked over it, yes.

Q No, no. Have you read it?

A Not the entire manual. No.

Q Do you understand it?

A Yes.

Q Where it says probability here, you see that? First line, 99?

A Yes.

Q That's what the probability matching system refers to as the class four probability, right? That's the class four match?

A It sounds familiar, but I'm not exactly sure.

Q And, over here, where it says C1, that's the class one match, do I have that right?

A I'm not sure.

Q What's the difference between the class four match and a class one match?

A I don't know.

Q Do you mean that you are using a computer that prints out probabilities and you don't know the meaning of the matches?

A No, I'm saying I don't know the meanings of the classes.

Q Well, when you got 99 here and 81 over here under C1, did you look up in the manual and see why there was a difference?

A No.

Q Well, you know that if this is the probability—that if the C1 is the probability that it's tetrahydrocannabinol, there is a 19 percent chance that it isn't, that is, that you would be wrong one time out of five, right?

A If that was the probability, roughly, yes.

Q Do you play poker?

A No, I don't.

Q Do you know anybody that plays poker?

A For fun maybe.

Q I understand for fun. Do you know anything about the game of poker?

A A little bit, yes.

Q Do you know that a flush is all of the same suit, right?

A Correct.

Q If you are playing five card stud, one card is down and four cards are up, right?

A I don't know.

Q Well, what kind of poker are you familiar with playing?

A I'm familiar with the hands; I'm not familiar with the different kinds of poker.

Q Well, if you are holding in a five card draw game, four cards

to a flush—If you hold four cards to a flush, would you draw for the fifth one?

A More than likely, yes.

Q You are willing to take a one-in about—about one-in-five shot, right?

A Yes.

Q You think you are reasonable, don't you?

A Yes.

Q Now, let me show you the exhibit that you were previously shown by me and then by Mr. Moustakis, Defendant's Exhibit I. And you told me that you didn't know what the 99 was, and you didn't know what the 81 was, and you knew there was something about a class 1 and class 4 probabilities, but you didn't know what they meant, do I have that right?

A Which 99 are you talking about?

Q The 99 here. Line one first column.

A That first 99?

Q Yes.

A Is the probability.

Q Is that a class 4 or a class 1?

A I'm not sure.

Q And is the 81 over under C1 a class 4 or a class 1?

A I'm not sure.

Q But you can see—You can see how it makes an enormous difference, can't you?

A There is a difference.

Q No, of course, there is a difference. The jury sees there is a difference—a difference between 99 and 81. 99 means that you have identified it to a probability of 99. And that leaves no room for doubt for practical purposes, right?

A For practical purposes, yes.

Q And 81, if that was the probability we rely on, that leaves plenty of room for doubt, right?

A Yes.

Q You said there would be room for plenty of doubt and you, Mr. _____, consider yourself a reasonable person, don't you?

A Yes.

* * *

Q You do consider that the process which you undertook and the opinions that you formulated to be reasonable, right?

A Yes, I did.

Q That is, you consider yourself a reasonable person?

A Yes.

Q And I believe you said as you went through that, as you went through the documents and decided what you would put in the list 600 and what you wouldn't put into the list 600, that if there was a doubt that you'd put it in. Right?

A That's correct.

Q And there were a number of such occasions in which there was such a doubt, right?

A Yes.

Q And do you know what it's called when a reasonable person has a doubt?

MR. EISEN: Objection, Your Honor.

THE COURT: Sustained.

The following response was given by a senior research chemist at an FDA laboratory:

Q And the validity of these searches, these library searches, is dependent upon a number of factors, one of them is the library. Right?

A Size—the size of the library, yes.

Q The size and disparateness, diversity of the library. Right?

A Yes.

Q That is, if you've got a library that's got 50 percent of the spectra in it are clenbuterol and your computer says the first three hits are clenbuterol, that doesn't really give you much information, does it?

A No, I would say that was kind of—stack the odds in your favor.

Q Sort of like the deck of cards that's got half queen of spades, right?

A Yes.

* * *

Q Can you quantify for me how different two spectra must be in order for you to reach the opinion that they are spectra of different substances?

A I am thinking.

Q There is nothing wrong with thinking.

A Yes. They have to be—you want me to give a quantity? A number? Is that correct?

Q Well, let's talk about it. How many peaks need to be off? That is, not to be identical in terms of their wave number for you to

conclude that the spectra are different?

A It has to be different.

Q No, no. Just answer my question. How many peaks have to be at different places for you to conclude that the spectra are of different substances? Or don't you know?

A Well, each spectrum is different. I can't give you a number.

Q If a peak is off by two reciprocal centimeters, is that significant?

A If we are talking about just one peak, no it is not.

Q I am now saying assume that two peaks on an infrared spectrum are off by more than—by two reciprocal centimeters. Is that in and of itself enough for you to say no, those are different substances?

A That is not enough information for me to have to evaluate the whole spectrum.

Q That is, it's a question of judgment?

A That's—well, if you want to call it that way, it is.

Q It's a question of judgment. And you can't give me an answer because you have to look at the whole thing. You can't give me an answer as to how many peaks would have to be off?

A That's correct.

Q And similarly, how many peaks have to be at the same place for you to say that it's the same substance? That the substances are the same? And it's the same answer? It's a question of judgment?

A I have to have both the standard and my sample in front of me to form that opinion.

Q And it's a judgment call. Do I have that—

A At that point, yes it is.

Q And do you agree with Dr. Camp that that judgment call is based upon your experience as part—that's part of what it is based on?

A Yes, it is, depending on training.

Q Experience, training, education, that sort of thing?

A Yes, it is.

Q And people who have more experience and more training and greater education, such as you have, could reach opinions different from people who have less training, less education, and less experience, true?

A No.

Q Is it your position that the judgment that you make concerning the identity of substances will be the same as the judgment of someone who has one tenth of your experience, one

tenth of your education, and one tenth of your training? Is that what you're saying?

A No.

REFUSAL TO ADMIT ERROR RATE

Q Now, you understand, do you not, that all scientific methodologies, whether you're using crystal tests, color tests, gas chromatograph, infrared, mass spectrometry, nuclear magnetic resonance, atomic absorption, spectroscopy, all of these methodologies have established error rates. You know that, don't you?

A Yes, there are errors, yes.

Q And, ma'am, what is the established error rate for the methodology which you employed? And give me the citation to the research or the treatise that supports your answer, if you know.

A For the methodology that I have adopted, there is no error rate.

Q That is, there is no known error rate?

A Not that I am aware of.

Q That is, you are not aware of any publication which would advise the jury what the error rate is of that methodology?

A I have not come across any such publication.

Q Have you searched for one?

A No, I have not.

* * *

Q And similarly, are you aware of any published data on the error rate of your methodology?

A No, I am not.

* * *

Q Now, every methodology, whether it's GC/MS or HPLC/UV, has an error rate of some sort. Right?

A That's correct.

Q Have you seen any data which shows the error rate of high performance liquid chromatography with an ultraviolet detector for the use of the analysis of animal feeds for compounds such as clenbuterol?

A You're speaking in very general terms, not in the specific instance of this case where we do not have a large body of data to analyze where we've had the luxury of being able to look at the sample for a period of months in order to establish statistical criteria of method validation or of error rate or of—which doesn't mean a lot

here—or of, what, ah, your standard deviation.

Q The answer to my question is you do not know what the error rate is of this methodology as applied to the search for clenbuterol in animal feed, do you?

A The error rate would be zero.

Q Have you seen anywhere in the world in the literature, sir, anywhere, where the HPLC system is said to have a zero error rate? Anywhere in the whole wide world.

A I haven't seen any error rate discussed in a sample of this type. In a pharmaceutical sample that might be different, but in a one time through the laboratory animal feed with unknown matrix, I have not seen that discussed.

Q That is, there is no known error rate for the methodology that you used in the circumstances in which you used it.

A That's correct.

CONCLUSION

In the end the proponent of the opinion relies on the experience and subjective certainty of the analyst and his adversary upon Karl Popper's view of the nature of scientific inquiry.

It may be of value to ignore for the moment the continuum of scientific validity of the pseudo-sciences and focus on the limiting cases.

At one end we have a recognized discipline which posits that all can be explained by the configuration of the solar system and its relationship to the precise date and time of a person's birth. The discipline is astrology. Its conclusions seem absurd to some, but acceptable to the majority of persons who read newspapers in our country. Surveys show that the astrology section is the second most read portion of the daily paper; the first is the sports section.

At the other end of the continuum is a discipline that concludes there are black holes in the universe in which all matter and energy disappear. The discipline is celestial mechanics.

Our intuition is of little help in assessing the relative plausibility of either the conclusions of astrologists or astrophysicists. And a traditional cross-examination would provide juries with little guidance to assess their relative credibility. Each will have authored treatises and articles; each will have held responsible positions in professional associations; each will have received specialized training in a recognized profession; each will have lectured at seminars; each discipline can trace its origins back hundreds of years.

Neither expert on cross-examination will admit that his

methodology is flawed. The courts which limit the gatekeeping function of the trial judge, if they rule consistently, will equally admit the opinions of the astrologer and astrophysicist and leave to their cross-examinations the test of their reliability.

The astrophysicist will fare better than the astrologer on the examinations illustrated in the foregoing examples. However, it seems unlikely that such inquiries into character will yield reliable decision processes.

With increasing frequency we read of conceded errors in criminal prosecutions by experience-based forensic analysts. The errors arise from flawed or deliberately falsified judgments, not from the data. Increasingly it is apparent that a vigorous traditional cross-examination is not a “universal solvent.” As Professors Denbeaux and Risinger noted in their contribution to this Symposium, “First, it seems clear that the narrower we draw the circle around the mechanic’s specific experience and training, the more reliable the allowed exercise of expertise will be (assuming any reliability in the first place).”⁶

The examples illustrate the consequences of drawing so narrow a circle that meaningful challenges to methodology are impossible and impeachment devolves into character assassination.

Daubert and *Kumho* are most difficult to apply to experts who profess to apply scientific principles to experience-based subjective judgments. Case specific cross-examination alone will not expose the trained and experienced charlatan.

⁶ Mark P. Denbeaux & D. Michael Risinger, *Kumho Tire and Expert Reliability: How the Question You Ask Gives The Answer You Get*, 34 SETON HALL L. REV. 15, 26 (2003).