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SUPREME COURT OF THE STATE OF CALIFORNIA

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| THE PEOPLE OF THE STATE OF CALIFORNIA,<br><br>Plaintiff-Respondent,<br><br>vs.<br><br>KEVIN COOPER,<br><br>Defendant-Appellant. | ) | CR 72787<br><br>Supreme Court<br>No. CRIM 24552 |

APPEAL FROM THE SUPERIOR COURT OF SAN DIEGO COUNTY

HONORABLE RICHARD C. GARNER, JUDGE PRESIDING

REPORTERS' TRANSCRIPT ON APPEAL

APPEARANCES:

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VOLUME 1 of 26 volumes.
Pages 1276 to 1409, incl.

JILL D. MC KIMMEY, C.S.R., C-2314
and
BRIAN V. RATEKIN, C.S.R., C-3715
Official Reporters

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN BERNARDINO

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| THE PEOPLE OF THE STATE OF CALIFORNIA, Plaintiff, vs. KEVIN COOPER, Defendant. | NO. OCR-9319 |
| | VOLUME 16 Pgs. 1276 thru 1409, incl. |

REPORTERS' DAILY TRANSCRIPT

BEFORE HONORABLE RICHARD C. GARNER, JUDGE

DEPARTMENT 3 - ONTARIO, CALIFORNIA

Wednesday, April 25, 1984

APPEARANCES:

For the People:
DENNIS KOTTMEIER
District Attorney

DENNIS KOTTMEIER
District Attorney
By: JOHN P. KOCHIS
Deputy District Attorney

For the Defendant:
DAVID McKENNA
Public Defender
By: DAVID NEGUS
Deputy Public Defender

Reported by:
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and
BRIAN RATEKIN
Official Reporter
C.S.R. No. 3715

# I N D E X



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ONTARIO, CALIFORNIA; WEDNESDAY, APRIL 25, 1984; 9:40 A.M.

DEPARTMENT NO. 3 HON. RICHARD C. GARNER, JUDGE

APPEARANCES:

The Defendant with his Counsel, DAVID NEGUS, Deputy Public Defender of San Bernardino County; DENNIS KOTTMEIER, District Attorney of San Bernardino County, and JOHN P. KOCHIS, Deputy District Attorney of San Bernardino County, representing the People of the State of California.

(Jill D. McKimmey, C.S.R., Official Reporter, C-2314, Brian Ratekin, C.S.R., Official Reporter, C-3715)

THE COURT: Good morning.

MR. KOCHIS: Your Honor, at this time, similar to the arrangement we had yesterday morning, I am going to call, with Mr. Negus' permission, of course, Brian Wraxall out of order before I complete my redirect with Mr. Gregonis.

THE COURT: Very well.

MR. KOCHIS: I would call Brian Wraxall to the stand at this time.

THE COURT: Raise your right hand, sir, for the oath.

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B R I A N W R A X A L L, called as a witness by the People, was examined and testified as follows:

THE CLERK: You do solemnly swear the testimony you are about to give in the action now pending before this court shall be the truth, the whole truth, and nothing but the truth, so help you God?

THE WITNESS: I do.

THE CLERK: Please be seated.

State your name, please, for the record, and spell your last name.

THE WITNESS: My name is Brian Wraxall, spelled W-r-a-x-a-l-l.

DIRECT EXAMINATION

BY MR. KOCHIS:

Q. Mr. Wraxall, what is your present business or occupation?

A. I am a forensic serologist.

Q. And at this period of time, by whom are you employed?

A. The Serological Research Institute, which is located in Emeryville in California.

Q. What position do you hold within that institute?

A. I am the chief forensic serologist and the executive director of the institute.

Q. Would you define for the Court what a forensic serologist is.

A. A forensic serologist is a person who is concerned with the isolation, the identification and individualization of blood and other body fluids, particularly as they relate to crimes of violence.

Q. And by "other body fluids", are you talking about, for example, among those, saliva and semen?

A. That's correct.

Q. Do you have any educational background in the area of either serology or forensic serology?

A. I was educated in England where I obtained a Higher National Certificate in Applied Biology, which would have covered the subjects of biochemistry, physiology and microbiology.

I was -- received most of my training in forensic serology on the job at the Metropolitan Police Forensic Science Laboratory which is located in London, England.

Q. How long were you employed by that particular laboratory in England?

A. I started work there in 1963, and for the first two years I was trained in general criminalistics, particularly in the biology division of that laboratory.

I then, after that time, began to specialize in forensic serology, and have been doing that ever since.

Q. How long did you specialize in forensic serology with the Metropolitan Police Department in London?

A. From approximately 1965 to 1977, when I came to this

country.

Q. Are you familiar with a person by the name of Dr. Culliford?

A. Bryan Culliford, yes. He was my immediate supervisor in London.

Q. And how long did you -- did you work under his direction at the crime lab in London?

A. Yes, I did.

Q. For how many years?

A. For the full length of time that I was there.

Q. And essentially what type of training did you receive with the Metropolitan Police in London in the area of forensic serology?

A. It was all on-the-job training in terms of the identification, the location of blood and other body fluids, the identification of those body fluids, and the species identification of blood, and then within the time -- when I was -- started working there, the only system I think that they were doing routinely was the ABO system. While I was there, a lot of the newer polymorphic enzymes and proteins were developed within that laboratory in its application to bloodstain and other body fluid stains, and so I was part and parcel of that development and was very familiar with that development as it became developed and introduced into routine casework.

Q. I take it at some point you came to this country?
A. Yes, I did.
Q. In what year?
A. In 1977.
Q. And is that in furtherance of any professional or occupational career?
A. Yes, it was.
Q. How did you come to come to this country?
A. I was invited to come to this country by LEAA, which is the Law Enforcement Assistance Administration, to work on a project funded by that agency known as the Blood-stain Analysis System, and I came in March of 1977 when that project had started, and worked on that until 19 -- the middle of 1978.
Q. What was your capacity or role within that particular project?
A. I was employed as a consultant to Beckman Industries, and the reason that I was employed that way was that the grant from the government first of all went to the Aerospace Corporation, and their main contract for this grant was Beckman Industries located in Southern California. They subcontracted that grant to the University of California in Berkeley, and I was employed as a consultant to Beckman, and I worked on that project under that role.
Q. And in a nutshell, the purpose of that project was what?

A. The purpose of it was to try and see if we could develop a system which would increase the capability of forensic serologists to enable them to group bloodstains in a much more efficient and also, of course, a reliable manner.

Q. At the conclusion of that project, did you then continue your employment in the field of serology?

A. Yes, I did.

Q. How so?

A. I was employed then by the Serological Research Institute which was started at that time, and the first -- for the first 12 months the Institute received another grant from I don't know whether it was LEAA at that time or whether they had become defunct and it was now funded under the National Institute of Law Enforcement and Criminal Justice, but I received a grant from them to conduct training -- serology workshops in training forensic serologists in the new techniques that had been developed under the bloodstain analysis system.

Q. Then I take it you've done teaching in the area of forensic serology in the past?

A. Yes, I have.

Q. And could you explain to the Court what that experience consisted of.

A. As an employee of the Metropolitan Police Laboratory,

I was responsible for training individuals from all over the world who came to that laboratory to learn new techniques, and as that laboratory was at the forefront in some of the newer blood grouping techniques, we would in fact entertain a number of people from different parts of the world, and one of my responsibilities was to train them in certain areas of forensic serology.

Q. Since your work with LEAA on the bloodstain analysis, have you continued to teach in the area of forensic serology?

A. Yes, I have. In the first 12 months between '78 and '79, of course, I trained people from all over this country in the new bloodstain analysis system techniques, and when that grant was finished, I still do training courses for people both at my laboratory and also on site at other people's laboratories.

Q. Have you likewise written any articles which have been accepted for publication in the field of forensic serology?

A. Yes, I have.

Q. What do those articles include?

A. There's approximately 12 articles that have been published which is concerned with grouping of bloodstains and semen stains, the identification of semen stains, and I have given also a number of seminars and papers

at professional meetings.

Q. For the record, directing your attention to what appears to be page 2 of your vitae, could you read into the record, starting at the top, the articles that you have written which have been accepted for publication in the field of forensic serology.

MR. NEGUS: I have no objection to the vitae being marked, if you'd rather do it that way, and have it directly introduced into evidence.

THE COURT: Okay. Do you want to mark it?

MR. KOCHIS: Yes, if I could have your clerk mark this as Exhibit 3, I believe.

THE CLERK: No. 6.

THE COURT: Six, accepted.

Q. BY MR. KOCHIS: Mr. Wraxall, the document I have just shown to you a moment ago, is this a copy of a vitae you sent me a week or so ago?

A. Yes, it is.

Q. And does it include a list of the articles that you've written which have been accepted for publication?

A. Yes, it does.

Q. Are you familiar with the term the ABO blood group system?

A. Yes, I am.

Q. And is that a concept that is recognized in the field of forensic serology?

A. Yes.
Q. And essentially involved in that concept is an understanding that there is an ABO blood group system which manifests itself in all human blood?
A. Yes. Basically, the ABO system consists of four main groups: A, B, AB and Type O, and every person within the world in general is one of those four groups.
Q. And within the community of forensic serology, is it an accepted concept that your ABO blood type is inherited, that it is determined genetically?
A. Yes.
Q. Likewise, within the concept, is it accepted in your community that a person's ABO blood type remains constant throughout their life?
A. That's correct.
Q. Are there within the forensic science community accepted methods for testing, for example, a sample of whole blood to determine a person's ABO blood type?
A. Yes, there are.
Q. For example, within your community, the forensic science community, is the slide agglutination technique considered a valid and reliable means of testing a sample of whole blood to determine a person's ABO blood type?
A. Yes, it is.
Q. Likewise, within your community, are there tests that

are accepted as valid and reliable for testing bloodstains, dried blood, to determine the ABO type of the person who deposited that particular stain?

A. Yes.

Q. And is the absorption-elution and Lattes test examples of tests that are recognized in your community as a valid and reliable means for making that determination?

A. Both those tests are accepted as reliable tests.

(No omissions.)

THE COURT: Excuse me just a moment.

Counsel, do you have anything?

(Discussion held regarding another matter.)

THE COURT: Very good. Thank you.

Q. (BY MR. KOCHIS:) Mr. Wraxall, are you also familiar with the concept of secretor versus non-secretor as it relates to the field of forensic serology?

A. Yes, I am.

Q. And what do these concepts consist of?

A. The definition of a secretor is a person who secretes his ABO blood group substance together with H substance into his body fluids as determined by a process known as absorption-inhibition. That means that if somebody is an A secretor, he will secrete into his body fluids -- "His body fluids," I'm talking about now, would be semen, saliva, perspiration, vaginal secretion, that type of thing -- he would secrete, if somebody's an A secretor, he would secrete A plus H. The B secretor would secrete B plus H. And an O secretor would just secrete H.

Q. And within your community of forensic serology is the absorption-inhibition test an acceptable means, a valid and reliable means to test the type of body fluids you have just mentioned, saliva and semen, to determine if someone is a secretor or not?

A. Yes, it is.

Q. Are you likewise familiar with the Lewis blood system?
A. I am.
Q. Is that essentially an antigen system?
A. Yes, it is.
Q. And is that separate and apart, as it were, from the ABO system?
A. Yes, it is.
Q. And is there a relationship between certain Lewis types in the whole blood and whether or not that person is a secretor or non-secretor?
A. Yes, there is.
Q. What is that relationship?
A. There are two antigens that you detect in the Lewis system. That's a and b. A person who is an a positive and b negative within the Lewis system is a non-secretor. A person who is an a negative, b positive is a secretor.

There is a third type, which is an a negative b negative, which means that the person is either a secretor or a non-secretor, and at that point you have to go to the saliva to determine the secretor status of the individual.

Q. Then within your community, community of forensic serology, is it accepted to make certain -- that one can make certain inferences from an examination of whole blood to find out a person's Lewis type as to whether or not that person is a secretor or not?

A. Yes. If you get a positive reaction for either a or b, you can certainly make the determination whether that person is a secretor or non-secretor.

Q. And are there tests that are accepted within your community as a valid and reliable means of testing for a particular Lewis antigen in whole blood that allow you to make this inference?

A. Yes.

Q. And is the micro -- microcapillary tube test one such test?

A. That's one of the accepted systems, yes.

Q. Are you familiar with the acid phosphatase test that is performed on a stain as an indication of whether or not the stain is in fact semen?

A. A presumptive test for semen is the acid phosphatase test, yes.

Q. And is that accepted within your community as one possible presumptive test to perform on a stain to make a determination as to whether the stain is semen or some other body fluid or some other substance?

A. Yes.

Q. Is -- it, of course, is possible to make that determination from tests other than the acid phosphatase test when we're talking about a particular stain?

A. Yes. For the identification of semen, the acid phosphatase test is normally one of the first tests that is done to give you some idea or some indication as to whether a

stain that you're looking at is in fact semen or not.

Q. Likewise, can you also just simply take the stain, look at it under a microscope to see if there's sperm present?

A. Yes. You would make an extract of that stain, and certainly that will be a confirmatory test for semen. If you found the presence of spermatozoa, then you know that you have semen present.

Q. And are you familiar with the -- the purpose for which forensic serologists look for the presence or absence of amylase in a particular stain when they're attempting to make a determination as to whether or not the stain is saliva or another body fluid?

A. Yes.

Q. And what is the purpose behind making that check?

A. The purpose is that amylase is present in a number of body fluids, but it's present in saliva in very large quantities. And it can give you an indication as to whether saliva is present or absent if you do an amylase test or you look for the enzyme amylase.

Q. Are there particular tests to detect the presence of amylase that are accepted in your community?

A. Yes.

Q. Can you give us an example of one or two of those by name.

A. Yeah. There's a couple. An agar diffusion test for the presence of amylase, whereby starch is incorporated into

an agar base and the amylase will in fact digest the starch, and then an iodine solution is poured over the plate afterwards, and where there's clear areas is where amylase is.

Q. Within your field, the field of forensic serology, is it an accepted concept that you can distinguish between individuals further than there ABO blood types?

A. Yes.

Q. For example, are there various enzymes that manifest themselves in human blood?

A. Yes, there a number of enzymes in fact in human blood and other body fluids, too.

Q. And is with the ABO groups system, is it accepted that the enzyme -- these various enzyme types are inherited genetically?

A. Yes.

Q. Likewise, do the various enzyme types that happen to be in the body of a particular person remain constant throughout the life of that particular person?

A. Yes, it does.

Q. Within your community, is there a procedure which is employed to test various stains to determine what the enzyme type of a particular blood stain is?

A. Yes.

Q. Is one of the procedures called electrophoresis?

A. Yes. Electrophoresis is a system by which normally you

can separate out the different isozymes or fractions of enzymes. And, you know, if they're polymorphic or if they show differences between people, then electrophoresis is a method by which this is normally done.

Q. And for the layman in the courtroom, including myself, could you define in a nutshell, if it's possible, what electrophoresis consists of.

A. Electrophoresis is basically a system whereby you have some sort of support medium. In most cases, this happens to be a gel type of substrate and, normally, like, a -- a slab of Jello. Into that slab of Jello is inserted bloodstains or the blood samples you wish to test. There are chemicals and buffers which are associated, and a series of conditions are going to be different depending on the enzyme system that you're looking at. After the insertion of the samples into the Jello and electric field is applied to that slab. Under the influence of the electric field, the enzymes separate out into their various components.

These are normally colorless. You can't see them. And you use specific biochemical stains in order to visualize those enzyme components. And depending on the position and number of those components will determine for you what type you have.

Q. Mr. Wraxall, I noticed when you described the procedure that you used with "samples," plural. By that is that

an indication that there are certain controls or standards that you use in this method of electrophoresis?

A. Yes. Most methods of electrophoresis will be very inefficient if you only could apply one sample at a time. And you can apply, depending on the system that you're using, but the average is between nine and a dozen samples can be applied to any one electrophoresis plate. Within that plate, of course, you should normally run some form of -- of standard samples, known samples to you for two reasons. One, to show that the electrophoretic system itself is working and that the separation is adequate for determination, and also to show that the reaction mixture or the staining mixture that you use is working properly so that you can visualize everything that's on the plate.

Q. In the past, have you yourself examined samples of whole blood to determine what the ABO blood type was of that particular whole blood?

A. Yes, many times.

Q. Could you estimate the number.

A. Thousands, probably.

Q. Likewise, with bloodstains, have you yourself analyzed bloodstains to determine the ABO blood type of the particular stain?

A. Yes.

Q. Approximately how many times?

A. It's -- it's hard to put a number on it. It's, over a

period of 20 years, I've probably looked at many hundreds of bloodstains.

Q. Likewise, have you performed tests to look for the Lewis antigen in whole blood to determine if a person was a secretor or not?

A. Yes.

Q. Again, on a number of times?

A. Yes, not as many as the ABO system, because the Lewis system has not been around for that long. It's probably only been in the last maybe four or five years that Lewis system -- the Lewis system has been used for secretor status.

Q. The procedure of electrophoresis, is that recognized in your community as a valid and reliable means of enzyme typing for dried blood, for bloodstains as well as whole blood?

A. Yes.

Q. Have you likewise performed that particular type of test in the past to determine the enzyme types of various whole blood samples?

A. Yes, I have.

Q. And have you likewise performed that type of test, electrophoretic analysis, on bloodstains to determine their enzyme type in the past?

A. Yes. And what I would say is a majority of times both blood samples and bloodstains are run at the same time.

Q. Once a stain is diluted so that it can be placed on the glass slide plate, is the procedure involved in analyzing whole blood and dry blood through electrophoretic techniques essentially the same?

A. Yes.

Q. Have you likewise in the past qualified as an expert in a court of law on ABO blood analysis, whether it's whole or stain?

A. Yes.

Q. Approximately how many times?

A. I have testified somewhere between, in this country, approximately 50 to 100 times. Now, whether they were on solely an ABO system or a combination of ABO and electrophoretic techniques I can't tell you.

Q. Have you qualified as an expert in this court -- in courts in California?

A. Yes, I have.

Q. Other states in the country?

A. Yes, I have.

Q. And those would include which states?

A. There's approximately, I think, 14 states. I have qualified as an expert in Oregon, Washington, Nevada, Ohio, Massachusetts, South Carolina, Georgia. There's probably some more if you want to look at my vitae, give you some indication.

Q. The states that you have qualified in as an expert, they

are indicated on the -- on one of the pages in the vitae which has been marked as Exhibit 6, I believe?

A. That's correct.

Q. Have studies --

THE COURT: Counsel, may I see that while we're waiting, unless you have need for it.

Q. (BY MR. KOCHIS:) Have studies been conducted on the reliability and validity of the test procedures to determine, for example, the various PGM types, for a moment putting aside the area of PGM subtyping, through the electrophoretic procedure?

A. Yes.

Q. And are you familiar with any of those studies?

A. Yes, I am.

Q. And can you recall the approximate year and the person who conducted those studies and what the results were?

A. Yes. There's been a series of studies on PGM as an individual system as opposed to combined with other systems. And in 1967, the PGM system was reported in the literature by Culliford out of the Metropolitan Laboratory, and there was a hundred percent accuracy on a large number of blood stains in that study. Since then, there have been other studies in 1974 by Zajac and Sprague, where 20-month old bloodstains were successfully typed. It does not give any indication of how many samples were used in that study.

(No omissions.)

Q. Mr. Wraxall, is it fair to say that when electrophoresis was initially developed, that the systems were run -- by "the systems", I mean different enzymes -- were run individually?

A. Yes; that's correct.

Q. And, for example, do the initial studies involving reliability and validity of electrophoretic techniques involve studies that were done on a single enzyme?

A. Yes.

Q. Likewise, with the EsD, I take it there is such an enzyme that we can refer to in this courtroom by those initials?

A. Yes, we can.

Q. Have studies been done on that enzyme with electrophoresis as a single system as to its accuracy and reliability to determine the EsD type of a particular bloodstain?

A. Yes.

Q. When and by whom and what were the results?

A. There is approximately four studies that I have references to. In 1975 there were two studies out of England, one out of the Metropolitan Police Laboratory by Parkin and Adams, and one out of another laboratory by Hayward and Bosworth. In the Parkin and Adams study, there was no problem with esterase D typing in three-week-old stains; and in the Hayward-Bosworth

study, there was no problems up to one month, and there they did approximately 200 stains.

Subsequently, there's been work by Blake and Sensabaugh. That's not a published paper, but a paper given at a CAC seminar, where work was shown -- where bloodstain work was done and shown to be reliable; and then a further study in 1977 by Grunbaum, Harmer, Del Re and Zajac where stains four weeks to two months were successfully typed on bloodstains.

Q. Now, are what are called blind trials applied to this test procedure to determine whether or not a particular method is valid and reliable?

A. A blind trial -- you know, there's many different definitions of a blind trial. In a lot of these sort of studies that I was certainly familiar with, there may not have been a bona fide blind trial in that somebody was given X number of stains and had no idea as to where they came from, and the best way to do that would be a double blind study, which would be done from an outside source. Most of the studies that I was involved in in the London laboratory would involve samples all of the time. As developments went on, I would be running bloodstain samples. I may or may not have known their type before I ran them, but certainly what I would do is, within the development stage when the results were read, go back and check to

see in fact if that bloodstain type was -- was matching with the original blood sample type, so there was no sort of record kept. You didn't produce -- in most examples of where studies have been done on electrophoretic typing, there's been no large-scale tables and records kept where X number of samples were done and that they were all double blinds. The majority of times, speaking for myself and the way it worked in the Metropolitan Laboratory, was that samples -- bloodstain samples were repeatedly being done on the systems, and to make sure that there was no problems or no errors creeping in; and if there was errors, then obviously there was something wrong and that needed to be resolved before (1) we would put it in a casework or (2) that we would publish the results.

Q. Turning to the EAP enzyme, have studies been done on the reliability and validity of the use of electrophoresis to type the different EAP types?

A. Yes.

Q. When and by whom and what were the results?

A. Again, there's several papers which were put out. In 1974 a group of people, McWright, et al, from the FBI laboratory, did some work on EAP typing on bloodstains. Myself and a lady called Emes put out a paper in 1976 whereby we looked at 387 stains from two days old to six weeks old, and all were reliably phenotyped.

Now, when I say reliably phenotyped, there might have been some of those stains that did not give any activity or gave weak activity and were not -- a determination as to its type was not made, but where a determination was made, they were all correct.

THE COURT: May I interrupt, please?

(Whereupon, there was a brief interruption in the proceedings.)

THE COURT: Thank you.

All right. Please continue.

Q. BY MR. KOCHIS: Mr. Wraxall, directing your attention to the ADA enzyme, have there been studies conducted on that particular enzyme and whether or not electrophoresis is a valid and reliable means of detecting the different ADA enzyme types in bloodstains?

A. The ADA system is a single system reported in Culliford's book, The Examination and Typing of Bloodstains in the Crime Laboratory. There has been no individual publication in a scientific journal regarding the reliability of ADA.

Q. When you're talking about Culliford's book, directing your attention to what has been marked for this hearing as K-5, is that the particular book that you referred to?

A. Yes, it is.

Q. Were you employed by the laboratory in London when

Mr. Culliford was doing that work?
A. Yes, indeed.
Q. And were you involved in that work?
A. Yes, I was.
Q. Turning to the AK enzyme, have there been studies of the reliability and validity of electrophoresis to determine the different AK enzyme types?
A. Yes. That was published in 1968 by Culliford and Wraxall, and in that study stains up to three months old have been very reliably typed in bloodstains.
Q. Directing your attention back for a moment to the ADA, did Culliford's work indicate that you could through electrophoresis validly and reliably type bloodstains to determine the various ADA types?
A. Yes, it did.
Q. Is there a particular serum protein called a Gc?
A. Yes, there is.
3a Q. And have studies been conducted to determine whether or not electrophoresis is a valid and reliable technique to determine the various Gc serum protein types?
A. Yes. There's been two studies on this, one by myself in 1975. Fifty stains two to thirty-three days old were all typed successfully. In 1977 Zajac and Grunbaum showed that stains up to two months old had been reliably typed.

Q. Are you likewise familiar with a serum protein named transferrin?
A. Yes, I am.
Q. And have there been any studies on the use of electrophoresis to determine the various transferrin serum protein types?
A. This has been a system that has only been recently utilized in forensic work, and some studies were done in 1983 by Blake where he showed the use of the transferrin system in bloodstains.
Q. And does Mr. Blake's study indicate that you can with the use of electrophoresis validly and reliably type transferrin serum protein types in bloodstains?
A. Yes.
Q. Is there an enzyme called peptidase A?
A. Yes, there is.
Q. And, likewise, have studies been done as to the reliability and validity of the use of electrophoresis to determine the various peptidase A enzyme types?
A. In bloodstains or bloodstains and semen?
Q. Let's discuss them together as a group.
A. Okay. There are two papers in fact where reliability studies have been done, first of all, on bloodstains. That was by Parkin in 1978, and on bloodstains he found that it was reliably -- he was reliably able to type peptidase A in bloodstains six to eight weeks old;

and in 1981 he produced another paper where he showed the reliability of typing peptidase A on semen stains, and that was up to six weeks.

Q. Mr. Wraxall, now that you have mentioned typing for enzymes in semen stains with the use of electrophoresis, is peptidase A the only enzyme type, for example, that is found in other body fluids, for example, semen?

A. No.

Q. Are there some enzyme types that exist in, for us laymen, greater quantities and, therefore, are easier to detect in semen stains than others?

A. Yes. Some enzyme types are there present in fairly large quantities and therefore able to be detected. There are others which are -- they are in such small amounts that our detection system is not sensitive enough to be able to put that -- to be able to determine that.

Q. The detection system that is used to determine enzyme types in semen, is that an electrophoretic technique?

A. Yes. It normally is the same as the system that you use for typing bloodstains.

Q. Can you use, for example, a sample off a bloodstain and a semen stain on the same plate when you look, for example, for the peptidase A enzyme?

A. Yes, you can.

Q. Is the PGM enzyme an example of an enzyme that one is

able to type through electrophoretic techniques?

A. Yes.

Q. And have studies been done as to the reliability and validity of electrophoresis to determine enzyme -- PGM enzyme types in semen stains?

A. Yes.

Q. And what do those studies indicate?

A. The studies -- and it was done by a group of people out of the Metropolitan Police Laboratory by Price, et al, and I believe that that was 1976, thereabouts, whereby a large number of stains -- semen stains were typed in the PGM system and the reliability was established.

(No omissions.)

Q. Is EsD an example of a particular enzyme that because of the quantity with which it exists in semen stains is not always able to be detected?

A. Yes.

Q. These -- the terms we have been using in the courtroom in regard to this electrophoretic technique, reliability and validity, essentially, in scientific terms, what does reliability mean?

A. Reliability?

Q. Yes.

A. Reliability is that if you took a technique and allowed, say, ten qualified serologists to use that technique on a particular bloodstain, they should all come up with the same result.

Q. For example, if Mr. Negus and I were qualified as serologists, would reliability involve a situation where, for example, in a blind setting if Mr. Negus and I, using the same procedure, analyzed these portions of the same bloodstain, we should receive the same results? For example, the same EsD types, PGM types as well?

A. You should, yes.

Q. And does the term "validity" in a scientific concept refer to the soundness of the theory -- the soundness of the theory itself?

A. Yes, I would agree to that.

Q. Turning your attention to CA II, is there an enzyme that

in this courtroom we can refer to by initials and numbers and CA II?

A. Yes. It stands for carbonic anhydrase, Roman numeral two.

Q. And have studies been done as to the validity and reliability of electrophoretic techniques on enzyme -- excuse me, on bloodstains to determine their CA II enzyme type?

A. Yes, there's three studies, one by Hughes in 1978, one by Andrus in 1980 where 21-week old stains were determined successfully, and a third study by Noppinger and Morrison in 1980, where 15-week old bloodstains were successfully typed.

Q. Are you familiar with haptoglobin?

A. I am.

Q. Is that an enzyme or serum protein?

A. It's a serum protein.

Q. Have studies been done as to whether or not, through the use of electrophoresis, you can determine in a valid and reliable fashion a person's haptoglobin type --

A. Yes.

Q. -- from a stain?

A. Yes.

Q. And are you familiar with any of those studies?

A. Yes. Haptoglobin was one of the earliest, in fact, I think, one of the first electrophoretic markers that was determined in bloodstains. And in 1966, Culliford and

myself produced a paper showing the reliability of haptoglobin in three-month old bloodstains.

Q. Now, are there considerations that may exist in a forensic laboratory for forensic serologists in typing a bloodstain that may not exist for, for example, a medical doctor in a blood bank who is typing a vial of whole blood?

A. Yes.

Q. And is size of the quantity -- is the size of the item you're about to examine one of those?

A. Yes.

Q. Okay. And on a small stain, is there often a problem if you use single system electrophoresis in that you will exhaust the stain before you run a sufficient number of tests to discriminate between two or more persons?

A. Yes.

Q. With that concept in mind, did you design a multisystem?

A. Yes, I did.

Q. And is that for the use of electrophoresis to determine the various enzyme and serum protein types?

A. Yes, it is.

Q. And in your multisystem, how did you group the particular enzymes or serum proteins?

A. This was part of the bloodstain analysis project which was founded by LEAA. And we were commissioned there to look at a number, in fact, all available polymorphic

enzymes and proteins, and with the final result that we should have a discrimination probability of one in two hundred and that the final results should be done on not more than three setups.

To obtain that discrimination probability, we had to use at least eight proteins and enzymes. And to get them into three -- only three setups, therefore, we had to start combining some of the proteins and enzymes together to enable that to be done.

Q. Now, as a -- as a forensic serologist, do you testify still in courtrooms as to bloodstain analysis?

A. I do.

Q. And do you testify for just the Prosecution or the Prosecution and the Defense?

A. I -- I testify for both Prosecution and the Defense.

Q. And do you test stains both to exclude individuals and to include individuals?

A. We test stains to see in fact whether they match or don't match anybody who may be involved in the case. If it does not match, then that person is excluded as donating that stain. If it does match, then he is included within a group of people who could have donated that stain.

Q. For example, do you often testify or have you testified for Defense lawyers that, based on the genetic makeup of the blood of their client and the genetic makeup of a

bloodstain that was lifted from a particular location, that the defendant could not have deposited that particular stain?

A. I have done that, yes.

Q. Do you use your multisystem in analyzing blood and semen stains in the work that you do?

A. Yes, I do.

Q. Are you the only forensic serologist in this country that uses your multisystem?

A. No.

Q. Now, have you subjected your multisystem to any tests to determine if it's a valid and reliable means of enzyme typing through the use of electrophoresis?

A. I have.

Q. And essentially by "a multisystem" -- well, for us laymen, if it's possible in a nutshell to explain the difference procedurally in the use of a multisystem, for example, for EsD and PGM as opposed to single electrophoretic techniques for EsD, PGM.

A. Yes. It's fairly simple. On a single system, basically you establish the parameters under which you can successfully separate a given enzyme.

Let's take, for example, esterase D. Those parameters are defined by experimentation. If they are acceptable, then you can go ahead and use that system.

PGM would have a different set of parameters. And

you would use that system and you use the parameters which you have established as reliable for that system.

With a multisystem what I intend to do is to alter the parameters. That enables us to separate out two or three enzymes at the same type. Within any electrophoretic system, the enzymes from a bloodstain are all there. For example, there may be eight or ten or even more enzymes present in any one given bloodstain. And under a set -- series of electrophoretic conditions, they may all separate out.

Now, whether they separate out adequately enough to be able to determine their types is another question. And in most cases that is not -- that is not possible. What happens with a multisystem is that those same enzymes are actually separated out. And we have established which enzymes separate out satisfactorily under a multisystem set of parameters. And if they do, what we go about trying to determine, or, separate. First of all, is the enzymes and then find ways in which you can detect the presence of those enzymes so that they don't overlap with one another. Because that's the problem with a multisystem if you're not careful, is that you can have an overlap.

If, for example, you try to develop something like a ten enzyme system on one given multisystem electrophoresis plate, you might end up with not being able to determine

which enzymes are reacting where because they're all masking each other. With the multisystem that I developed, we try to make sure that there was no overlap. And in fact there is no overlap with the systems that are used in the multisystem.

Q. Your multisystem?

A. Yes.

Q. How many different groups did you break the serum proteins and enzymes down into?

A. Essentially three. We labeled them Group I, Group II and Group III.

Q. Has that changed or is it still three, or do you now have four?

A. There's now four.

Q. And is that a modification of your original system?

A. It's just an addition. It's not a modification at all. The original Groups I, II and III are still done basically the same as they originally were developed with slight, you know, fine tuning modifications.

The Group IV is a separate system that was developed for us to look at race related markers.

Q. What -- which enzymes is your system in the Group I series designed to look for?

A. Designed to look for three systems, three enzyme systems: glyoxalase or GLO, EsD and PGM.

Q. Which enzymes is your system designed to look for in the

Group II system?

A. In that system is three more enzymes: ADA, EAP and AK.

Q. Your Group III system, is that a system designed to look for enzymes or serum proteins?

A. Serum proteins.

Q. Which serum proteins?

A. Initially it was designed to look at Gc and haptoglobin. And we have now added a third one, which is transferrin.

Q. And is there a system by which you look for the carbonic anhydrase and peptidase A?

A. Yes.

Q. Is that now the IV system?

A. That's part of the Group IV system, yes.

Q. Are there any others that your system is designed to look for in Group IV?

A. Yes. There's two other enzymes, or, one other enzyme and one other protein, I guess. One is G6PD, and then the other one is hemoglobin.

Q. Is there any problem that you're aware of in terms of reliability and validity in the use of your system with, for example, in the Group I system, not looking for all three, for example, looking simply for the PGM and EsD?

A. No. Glyoxalase has always been a tricky system. Even on an individual basis it has one that has not been very easily adopted by a lot of people. And I do find that

some people have very good success with glyoxalase and some people don't. And there's nothing wrong with just looking, in fact, you could just look for PGM if you were only well trained in the analysis of PGM. Then until you were trained in the analysis of esterase D or glyoxalase, I would not advise anybody to do it.

Q. And essentially your -- your multisystem approach, for example, as to Group I, would involve you looking for three enzymes, the GLO, the EsD and the PGM, off the same plate which is run one time?

A. That's right, on the same piece of material.

Q. And you may read the enzymes or you will read the enzymes separately, but the plate is run once?

A. That's correct.

Q. On a single system, that plate would be run three separate times?

A. That's right. And there would be three different plates and using three individual -- different pieces of material.

Q. And three portions of standards?

A. Yes.

Q. What tests have you subjected your multisystem to to determine if it's a valid and reliable method of conducting this electrophoretic technique on more than one enzyme on the same plate?

A. As part of the Bloodstain Analysis System, as part of the

project, as the methods were being developed, of course, we would be subjecting them all the time to studies involving bloodstains, because it doesn't matter how good a -- a system is working on whole blood; if it doesn't work on bloodstains, it's no use to a forensic serologist. So as the methods were being developed, of course, we would be running bloodstains all the time.

When we were satisfied that the methods were fully developed and within the time constraints that we had, we were then, as part of the project, that methodology was subjected to an external blind trial in that approximately, in fact, 18 bloodstains were submitted to me and I had to run those 18 stains for all 18 enzymes and protein systems using the multisystem as it had been developed. There were approximately 144 readings within that set of blood trials, and there was one error.

Q. And to reference that particular procedure, was that sometime between or during 1978 and 1979 -- 1977, 1978?

A. It was approximately sometime in January of 1978 that that test was run.

Q. In 1978, were you also given the responsibility to train approximately 94 people in the use of your multisystem technique?

A. Yes. That was after the completion of the project.

What I might say is, though, that as part of the

original project we were also asked to train four individual serologists from four different crime laboratories, and they were trained for two weeks at the Beckman facility and then sent back to their laboratories and sent blind trial samples, in other words, samples that we knew the -- the enzyme types of. And they were then asked to tell us what those types were. This was known as a feasibility testing program, because it, again, it was no good if only I could do the test or I could use the methodology; it was important to make sure that other people could be trained in that methodology and were able to in fact determine the enzyme and protein types on unknown bloodstains.

(No omissions.)

5-1

Q. Now, Mr. Wraxall, those four people, they were all trained in the use of your multisystem?

A. That's correct.

Q. And that involved their ability to read the various enzymes we've talked about?

A. That's correct.

Q. Approximately how many readings were involved in terms of blind studies for those four individuals during the course of your follow-up feasibility test?

A. In that, there were a total of 912 readings made by the four people, and of those, only one reading was made incorrectly.

Q. And was that to you an indication that your multisystem in terms of being used by persons other than yourself was a valid and reliable technique to make the various determinations as to serum proteins and enzyme typings?

A. Yes.

Q Did you likewise continue to subject your system to additional tests?

A. Yes, I did.

Q. And the next type of test would have consisted of what?

A. After the completion of that project, we were given another grant to complete the forensic serology work-shops, which was basically teaching a large number of people from across the country in the new methodologies that have been developed. We had approximately 94

different serologists attend the laboratory at SERI, and we trained them for two or three weeks. The training was depending on the experience of the analyst, because we were receiving people who had not done any electrophoresis typing at all, and so they required an extra week to merely make sure that they understood and learned all of the different parameters that were involved.

As part of their training, at the end of each course, they were given a series of blind trials in my laboratory and a large number of readings were obtained from them, and again we have over 3,000 -- approximately nearly 4,000 different readings. Out of that, there were only 36 errors, but what I might say too is that as part of that, in all cases where the stain was repeated by them, the correct type was obtained.

Q. Do you continue to this day to train people in the use of your particular multisystem?

A. Yes, I do.

Q. And do you continue to keep tabs on the system, as it were, with follow-up blind testing?

A. Yes. We give blind testing at the laboratory. If they require stuff -- further blind testing when they go back, we were happy to supply those to them at that time.

5-3

Q. Mr. Wraxall, directing your attention to a diagram which we have placed behind you on the board, which I believe for this hearing has been marked for identification as K-1 --

A. Yes.

Q. -- starting with the Group I at the top, in your community, in the community of forensic serology, is the use of an agarose/starch gel considered an appropriate gel to select in conducting an electrophoretic analysis to determine the EsD and PGM enzyme types?

A. Yes.

Q. And are certain buffers required to be used when you conduct this type of analysis?

A. Yes. I mean, you can use different buffers, but the ones I'm familiar with, the ones that were developed under the multisystem concept, are those that are up there.

Q. Moving across the line, do you notice on the chart for each group above the group we have "gel", then we have the buffer with the description of the buffer used, the pH at which the test was run, and the various stains that were used in the staining procedure? For the Group I, are you able to read all of those on the chart?

A. Yes, I can read those.

5-4

Q. On the chart as they appear, is that an acceptable buffer, for example, to use on the Group I electrophoresis?

A. Yes.

Q. And the pH that appears on the diagram, is that an acceptable pH at which to run the plate?

A. Yes.

Q. Is there -- how about the staining technique or the use of those particular stains? Are those stains that you recognize or --

A. Yes. They're all recognizable to me as valid procedures for that -- that system.

Q. Likewise, on the diagram on K-2, directing your attention to the same information that appears on a line next to Group II which is in your system, I believe the search for the various EAP, ADA and AK enzyme types, is it acceptable to use simply a starch gel medium when you run the electrophoresis for the Group II enzymes?

A. Yes.

Q. And is there any -- do you have any quarrel with the particular buffer that appears on that particular chart or is this a proper buffer to use in the Group II?

A. The buffer is fine for that system.

Q. Likewise, with the pH and the particular stains that were used, are those acceptable -- is this an acceptable

pH in all stains for the Group II?

A. Yes.

Q. Likewise, for the Group III, the serum proteins, the transferrin and the Gc, is it acceptable within your field to run an electrophoresis run using an agarose gel in the search for those serum proteins?

A. Yes.

Q. Is that an acceptable buffer, the one that appears on the chart?

A. Yes.

Q. And how about the pH?

A. Yes.

Q. And by "yes", I assume you mean that would be an appropriate pH to run that particular plate at?

A. That's correct.

Q. And is it proper procedure to stain the plate with an antiserum?

A. Yes. That would have to be a specific anti Gc serum, if that's what you're looking for, an anti-transferrin serum, depending on what you would -- what particular protein you're looking for, of course.

5b Q. And, likewise -- let me ask you with your current Group IV system, do you recommend that the medium, the gel to be used, is agarose or another medium?

A. Agarose.

Q. And the TRIS/phosphate, is this a buffer that you either

recommend or that you're aware is a proper buffer to use?

A. Yes. That was the buffer that was developed for the use in the Group IV system.

Q. Is a 7.4 pH proper on the Group IV?

A. It is.

Q. And the stains that appear there for the PEP A and the CA II, do those appear to be appropriate stains to use in reading the plate for those two enzymes?

A. They do.

Q. Now, you don't use an acrylamide gradient gel yourself when you run your haptoglobin, do you?

A. Not at this time. I have used the gradient gel. In fact, I used it all the time and was part -- I was part of the development of that in England, but now I use just a straightforward non-gradient acrylamide gel.

Q. Is the use of an acrylamide gradient gel within your community, within the forensic science community, accepted as a valid and reliable gel to use when you conduct an electrophoretic analysis of a stain to determine the haptoglobin enzyme type?

A. Yes, it is.

Q. And the buffer that appears on that particular chart, is that a buffer that's accepted in your community as the proper buffer to use in that type of analysis?

A. Yes.
Q. Is the pH also considered proper?
A. Yes.
Q. Is there anything about the use of that particular stain in the staining procedure looking for the haptoglobin?
A. None whatsoever.
Q. Are you familiar with the terms of "wet stain" and "dry stain" as they may relate to changes that may occur within the -- a particular stain in the serum proteins and the enzymes within the stain?
A. Yes.
Q. And, for example, wet stain changes to us laymen would apply to what -- what condition would the sample be?
A. In terms of -- basically, when you -- when blood is spilled, there are -- it goes through a number of changes. Most of the time it's going to dry fairly quickly, but depending on the conditions under which it is kept while it is drying would depend really how fast or how slow it dries. Most times if there is very little humidity, the stain is small, and the temperature is room temperature -- and for that, we will just use an arbitrary figure of 68 degrees -- the stain is going to dry fairly rapidly and there is going to be little or no alteration to the -- or

degradation of the blood.

If, however, you have a pool of blood on which maybe a body is lying and it is in a very humid atmosphere and the temperature is fairly warm, then that blood, particularly if it is in a large pool, will take a little bit longer to dry. It is possible under some conditions that that will be a wet stain and that it is drying slowly. Under those conditions, you can see a certain amount of degradation of the proteins and enzymes.

Q. If you come upon a wet bloodstain -- that's a contradiction in terms. If you come across --

A. Well, I understand what you mean.

Q. Excuse me.

A. I understand what you mean.

Q. If you come across a substance that appears to be in a liquid form, it appears to be blood, can you arrest some of the potential wet stain problems that may arise by drying the stain and freezing it?

A. Yes, you can.

Q. Now,do enzymes and serum proteins last forever?

A. Unfortunately, no.

Q. And would that include stains that are frozen as well as stains that are left at room temperature?

A. Normally speaking, the quicker that a stain is dried and the lower the temperature at which it is stored,

the longer it will last.

Q. When a stain doesn't last forever, I take it then the enzymes and serum proteins undergo some type of degradation?

A. Yes.

Q. And will this degradation often manifest itself when you conduct an electrophoretic analysis of a stain?

A. I'm not sure I understand the question. Are you saying that we lose the activity or --

Q For example, when enzymes -- let me clarify that -- degrade, do they in fact lose their activity which may affect your ability through the use of electrophoresis to get any reading whatsoever?

A. Yes.

Q. Mr. Wraxall, based on your reading in the field -- and I take it in addition -- well, let me not take anything for granted. Let me ask you the question. In addition to the articles that appear in your vitae that you've written, have you read -- do you regularly read in the field of serology?

A. Yes, I do.

Q. And do you regularly subscribe -- for example, does your laboratory regularly subscribe to the journals that come out in that particular field?

A. Yes.

Q. And based on the reading that you've done, based on

your experience and your education, do you have an opinion as to whether or not within your community the use of a multisystem, electrophoretic multisystem, is a valid and reliable means to determine the type of enzymes and serum proteins that we've discussed here this morning?

A. Yes, I do have an opinion as to that.

Q. And what is your opinion?

A. My opinion is that the enzymes and protein systems that we've discussed here this morning are reliable, and that they are a valid means of typing blood and other body fluid stains.

(No omissions.)

Q Are you the only person in your community that holds that position?

A No.

Q And is that proposition likewise accepted by many serologists in the forensic serologist community?

A Yes.

MR. KOCHIS: I have no further questions at this time.

THE COURT: Let's take the morning recess at this time. Fifteen minutes.

(Recess.)

THE COURT: Have you concluded?

MR. KOCHIS: I'm asking permission to reopen direct on a point.

THE COURT: No problem.

Q (BY MR. KOCHIS:) Mr. Wraxall, directing your attention to what has been marked for identification in this hearing as K-4, do you recognize what that is a Xerox copy of?

A Yes.

Q And is that in fact a Xerox copy of a chapter that you have written?

A Yes, it is.

Q In what publication or --

A That's a chapter on forensic serology in the Practice in Law Institute's book on Scientific and Expert Evidence.

Q And was it essentially a chapter you wrote to inform lay

people such as lawyers about some of the basic concepts and terms of definition that we have talked about here this morning?

A. Yes.

MR. KOCHIS: I have nothing further.

And, Your Honor, I would at this time offer that into evidence for the Court to read at its leisure for an understanding of some of the terms we have been using in the courtroom.

THE COURT: If you promise to sit down so Mr. Negus can proceed if we accept it.

MR. KOCHIS: Yes.

THE COURT: All right. It will be received.

THE CLERK; Is that No. 6, Your Honor?

MR. NEGUS: I think it's K-4.

THE WITNESS: K-4.

THE COURT: Go ahead, Mr. Negus.

CROSS EXAMINATION

BY MR. NEGUS:

Q. Mr. Wraxall, when you were listing the literature as to the various enzymes, that literature was essentially literature which had to do with reliable -- the reliability of typing of the enzymes; is that correct?

A. In -- in bloodstains, yes.

Q. Basically most of the articles in the literature would

state the procedures and then give a discussion of the procedures and then give a -- give the results of the testing of those procedures; is that --

A. That's correct.

Q. Does there also exist literature in forensic serology of things that can wrong with the typing of various enzymes?

A. Yes.

Q. For example, have you yourself and Dr. George Sensabaugh written -- written a brief piece on things that can go wrong with typing of acid phosphatase?

A. Yes.

Q. In that particular -- in that particular article, do you develop two rules that you say should be fulfilled before a typing call is made?

A. Yes.

Q. What are those rules?

A. One is for the use of adquate controls. And I believe we recommend the use of a type BA and a type CB within the EAP system. And the other one, I think, is to be careful in allowing things to develop within the electrophoresis plate.

Q. What -- why is -- why is that a problem?

A. Heat can cause a problem with EAP. The three main types in EAP, A, B and C, have different stabilities. And heat denaturization can occur with EAP in that the Type A is

the most labile, followed by the B, followed by the C.

Q. What problems does that cause in typing?

A. It can cause problems in that you can get alterations of Type B, for example, to a Type CB. These have been -- this -- this problem has been well known for sometime. And it normally occurs because, within the EAP system, there's a particular problem in that it's not simply a question of separating the enzymes out. There is qualitative differences but also quantitative differences.

Q. That is to say that, for example, between a B and a C you'll have bands in the same place, but the typing involves the relative intensity of the bands?

A. That's correct.

Q. Do you also develop in that article a rule that you shouldn't type just on the presence of one band?

A. That's correct.

Q. And that's because of this problem of -- of the different bands disappearing at different rates?

A. That's correct.

Q. In the -- what sort of controls do you recommend to take care of the problem of heating?

A. The BA and the CB controls and also a type B, which you can also include on the plate, would also take care of this. Because if you have a known B and in fact it looks like a CB when you finally develop the plate, then there's an indication one of two things have happened: either the

sample is denatured itself or there has been a heating effect caused in the plate.

Q. So basically what you have to do is make sure you get the correct result on your known samples in order to make a call of the plate?

A. That's right.

Q. If you don't do that, the reliability of the procedure can be adversely affected; is that correct?

A. The reliability not of the procedure but the reliability of the typing of the stains on that plate can be affected.

Q. Were there any other problems or things that can go wrong with typing of acid phosphatase which were developed in that article?

A. I can't recall offhand. I'm sure you've got a copy.

Q. May I refresh your recollection?

Well, for example, showing you a copy of that article from your library, I believe.

A. Yes.

Q. Would that refresh your recollection as to what the other problems might be?

A. Yeah. I mean, I can -- I can go through and read it, if you'd like to point me in the correct -- in the --

Q. Well, there's -- there's a list of four different -- four different things that can go wrong there.

A. Yeah, sure.

Q. One of them was the problem of heat, which you have

already mentioned.

A. Right.

Q. And what were the other three?

A. The difference in intense -- staining intensity of the isozyme bands, which we have already talked about, correct?

Q. How do you -- what -- what -- how do you prevent that from causing mistyping?

A. Again, by using controls. You just have to -- the -- the -- first of all, you use the control -- the controls as I have mentioned before, and you also in fact only make sure that you read when you have at least two isozymes present. Okay. And that is because of the subsequent dilution effects that you can get.

For example, this is mainly a problem between a B and a BA. If you have a -- take a BA sample and dilute it to the point the most intense band that is left is a B band, okay, the faster B band, the A's and the C will disappear. If you take a Type B and do the same thing to it, the last thing that you're left with again is the main type B band.

So we have found, though, that the A bands and the C band in a BA can go out at about the same time. So if you see a Type -- an intense B band and a C band and you don't see any A bands, then you can fairly be safe in calling it a B as opposed to a BA that is degraded or has

been diluted.

Q. Another problem that you identified is a problem with substrates; is that correct? What is that -- what is that problem?

A. The substrate I believe is -- what we're talking about there is the affinity for different substrates within the reaction. And I think we're talking about there as to whether glycerol is included in the reaction mixture or not.

Q. Well, I believe that there's a separate -- separate problem that with -- with glycerol -- in the one that's listed on the board there, in the system that's listed on the board there in K-1, glycerol is not used; is that correct?

A. That's correct.

Q. So that problem wouldn't exist?

A. That's correct.

Q. But there is a separate --

A. Yes, there is one here in fact where it talks about the affinity for the substrate, and the substrate concentration is important in that.

Q. Okay. What -- what -- what kind -- what substrate are we talking about there with the substrate?

A. The substrate would be MUP or methylumbelliferyl phosphate

Q. And that is -- that is a chemical that is used in making the -- the different bands fluoresce when they are

exposed to ultraviolet light?

A. Correct.

Q. How does -- how does -- how does that cause typing errors?

A. I don't know that it does if you don't use -- if you use enough or you don't use too much, and that's been developed by experimentation. The amount that we use and which has been recommended generally doesn't cause us any problems that we have seen.

Q. Are there any things that can go wrong in the typing of EAP that are not mentioned in that particular article which was published in 1977?

A. Not that I can think of offhand. Those are the common things that occur. I mean, you can get distortion of your band patterns, you can get -- within electrophoresis, a number of things can go wrong. But normally those are very well controlled because you have standards on there or control samples.

(No omissions.)

7-1

Q. So, again, the existence of the control samples to the known samples is the key to making sure there's nothing going wrong with your system?

A. Yes, indeed.

Q. Without the use of known samples, is the system -- would the system be reliable?

A. It can be. If you have enough experience, you should be able to show that there is good activity and there is good separation just using unknown blood samples. Some systems you can get away without using control samples. Others -- EAP I don't think that you should. I think you should use some control samples, because then you have the control of the degree of separation and also the activity, and also it can give you signposts as to indicate whether anything is going wrong.

Q. What other enzymes that you use in your multisystem should you always be sure to include in a control?

A. We recommend controls in all of the multisystem, mainly because, for example, in PGM system, if you have enough experience, you can tell those apart very easily. You really don't need a control, but in a multisystem, it's a good idea to have a known control which will separate out all of the known bands that can exist so that you show -- because of the parameters are a little bit more carefully

controlled within a multisystem concept. You can then show that everything is working correctly in terms of the separation at least.

Q. So for the PGM you would use the heterozygote 2-1 as your control?

A. That's correct.

Q. That would show all the different bands that you're looking at?

A. Correct.

Q. And is that essentially the principle that you use in the other serum proteins, basically the most common heterozygote as your control?

A. That is normally the way that it's done.

Q. The reason that acid phosphatase has the two controls is because there's -- in order to get all the different bands, you need at least those two different --

A. Well, the BA will show you all four bands, but we have a quantitative difference as well as a qualitative, so you want to be able to see that your CB, for example, gives you a direct comparison when you are trying to differentiate between a B and a CB on an unknown sample.

Q. So that's to make sure you've got the different relative intensities there?

A. Correct.

Q. With respect to PGM, does there exist a -- in the

literature an article similar to that by yourself and Dr. Sensabaugh on things that can go wrong with PGM typing?

A. Not that I'm aware of.

Q. What about with esterase D?

A. Esterase D -- esterase D before the multisystem, there was a potential problem with esterase D in that the separation wasn't very good, and storage bands could interfere with your interpretation and differentiation between a 1 and a 2-1.

Q. That was using a starch gel procedure?

A. With a different buffer system.

Q. The agarose in the buffer system that you use in the multisystem cleared up the storage bands to a certain extent and made sure you got the proper separations?

A. Yes, it did. It increased the separation so much that the storage band did not fall where the second band came, which was what the problem was with the initial system.

Q. There's a shadow now?

A. Yes.

Q. Any literature on things that can go wrong with esterase D under the multisystem?

A. No, not that I'm aware of.

Q. What about with the glyoxalase 1?

A. Well, glyoxalase 1, I believe there's some reports.

7-4

Whether it's in the literature or whether I've heard these verbally or whether I've seen it myself, you can get an anodal shift of the banding, and that's normally seen when you do not have a reducing agent present. Glyoxalase itself is a system which, as I testified earlier, has a few problems in whether people have the ability to use it or not, and some people do, and some people don't.

Q. What are those problems?

A. The problems is normally within the staining, and there's a very fine balance. It's a two-staining procedure. It's different from most of the other enzymes that we look at, in that the glyoxalase requires you to stain with one substrate and then to overlayer with a second, and the balance between the first and the second is very critical; and if you throw that off balance, you don't get any result.

Q. When the -- when the multisystem was originally developed on the gel for the Group I, you have right now an agarose/starch gel; is that correct?

A. That's correct, yes.

Q. And your recommendation is that it be one percent agarose, two percent starch?

A. It can vary. In fact, the difference between one percent -- originally, it was one percent starch -- excuse me -- one percent agarose, two percent starch. We have now

reduced that to one percent agarose, one percent starch. The reason the starch is there is purely -- it has nothing to do with the separation. It is purely for the development of the glyoxalase.

7a Q So if you weren't using glyoxalase in your system, you wouldn't even need the starch?

A You don't need to use it, no.

Q And that's because the most sensitive way to stain the glyoxalase requires the presence of starch in the chemical reaction?

A Yes.

Q Will problems in not being able to stain the glyoxalase correctly produce incorrect results?

A No. Normally, you get nothing -- normally, if you can't stain it, you don't see anything at all. Even your controls don't work, but you don't call anything, because there's no activity.

Q Should there be any problems with mistyping glyoxalase if you get a result?

A You have to be a little bit aware of storage bands, and that applies to not only glyoxalase, but some other systems too, and you need to know where they occur and their intensity.

Q Do the tests that you've done establish that in the hands of a competent operator that glyoxalase is a reliable system?

A. Yes.
Q. And you've done innumerable blind trials of one -- one degree of blindness or another to confirm that?
A. Yes.
Q. In fact, that was part of the original contract that you had with Beckman Aerospace?
A. That's correct.
Q. Are there any other problems that can lead to typing problems with glyoxalase other than those that you've already mentioned?
A. Not that I can recall at this time.
Q. Are there any things that can go wrong with esterase D using the multisystem, the agarose to separate it?
A. In terms of mistyping?
Q. Yes.
A. No.
Q. What about in terms of -- of being unable to type?
A. You can sometimes -- one of the problems that can arise is that if you don't use a reducing agent, you can see nothing at all, and by use of the reducing agent, you can in fact revitalize that enzyme.
Q. Is there anything about PGM which makes it difficult to develop the visible stain like there is with glyoxalase?
A. Not so much. It just depends on whether there's enough enzyme activity there to start with, but you

don't generally have a failure of the PGM staining overall like you can have with glyoxalase.

Q. Is one of the advantages of the multisystem approach that you can -- if you see a problem in one of the enzymes in your group, you can -- that will alert you to possible problems in the other enzymes?

A. Yes.

Q. In comparing the amount of PGM in the average person with the amount of esterase D in terms of the enzymatic activity, which one's going to be -- will produce the greater amount of activity?

A. I don't know whether that study has been done. I could tell you in terms of its stability.

Q. Which is the more stable?

A. PGM.

Q. Is it a normal occurrence to have a situation where -- where esterase D will come out clearly and the PGM won't?

A. That's a possibility. We've seen that.

Q. And what causes that?

A. I don't really know. It may just be that the level of detectability within that enzyme that the PGM has gone off quicker than the esterase D for some reason. I don't know.

Q. What if you had a whole plate, standards, what have you, where the esterase D appeared considerably stronger

than the PGM?

A. Then the possibility is that the PGM reaction was not optimized.

Q. What could cause that?

A. Mainly, the liquid enzyme that is used in that reaction is known as G6PD.

Q. And what does G6PD have to do with it?

A. G6PD is part of the reaction and is required. If you leave G6PD out, you get no reaction going at all; so if G6PD in fact is -- the enzyme activity is reduced or you don't put enough in, then you can get a weak or no staining activity at all.

Q. The G6PD that you use to stain the PGM, is that the same G6PD that you use that you're analyzing in your Group IV system?

A. Absolutely.

Q. And that particular enzyme doesn't last very long; is that correct?

A. That's correct.

Q. Can a weak or almost degraded PGM cause typing problems if you use that in your stain?

A. Yeah.

Q. What are those?

A. You may not see anything.

Q. What if you see -- can it cause the sort of differential problems that you discussed with respect

to -- to acid phosphatase where some bands will go and others won't?

A. No.

Q. Are all the bands in, say, a PGM 2-1 the same?

A. Generally speaking, yes, they are -- no. That's not -- that's not true. Let's look at it from -- let's look at in fact the PGM 2-1. There are four main bands in those. We'll call them a, b, c and d, normally speaking, the a and b being a little stronger than the c and d, but if you lost c and d on a 2-1, you have still got the a and b, and that's still a 2-1.

(No omissions.)

Q. PGM subtyping by isoelectric focusing will just -- will just be looking at those a and b bands; is that correct?

A. That's correct.

Q. Are there any rare alleles in PGM besides the two and the one?

A. Yes.

Q. How many?

A. I think there is a total of eight or nine more. That was the last count. There might be some more that have been developed.

Q. Will the multisystem show those different variants?

A. Yes.

Q. All of them should be able to be picked up on the multi-system?

A. Yes.

Q. What about esterase D? Are there any rare variants to that?

A. There is a couple. I can't remember how -- I remember an esterase D 3, 4 and 5.

Q. Will the multisystem show those and distinguish them from the -- the 1 and the 2?

A. 3 and 4, yes. 5, no. 5-1 and 2-1 on the multisystem and, in fact, any conventional system look the same. You have to go isoelectric focusing to differentiate that.

Q. Isoelectric focusing for esterase D in stains over 48 hours is basically unreliable; is that correct?

A. So it is said. I don't believe that.
Q. That was -- you don't believe the -- the published article to that effect?
A. That's right.
Q. What about glyoxalase? Are there any rare variants in that?
A. I don't know that there have been any reported in that. Up to a -- just a couple of years ago there were no reported variants, and I don't recall any reported variants on the glyoxalase system.
Q. What about the acid phosphatase system? Are there any rare variants in that?
A. Yes, there are.
Q. How many?
A. Well, I'll give you the alleles so that you know. There's the R and there's the B -- excuse me, the D and the E.
Q. Okay. Will the D the E and the R all show up on the multisystem?
A. The D and the E will. The R is a little bit, shall we say, tricky to distinguish, between the R's and some of the others. But there are ways in which you can get a -- an indication that you've got an R, and then you go to another buffer system to check that out.
Q. So you should be able to recognize at least the possibility of an R by looking at the plate?
A. Yes.

Q What about AK? Are there any rare variants to that?
A Yes, there are.
Q Will they show up on the multisystem?
A As far as I know, they will.
Q ADA?
A Yes. Oh -- I can't recall if there are variants or not in ADA. I think there are. I think there is. I think there's a couple. I think there's a 3 and maybe a 4.
Q Do they show up on the multisystem as well?
A As far as I know, they will.
Q What about transferrin? Are there rare variants of that?
A Well, there are variants of that, and I guess you could call them rare, because the majority of Caucasians are Type C, and in Caucasians there's CB's, and in blacks there are CD's. And there are different types of D's and different types of B's.
Q Will -- during -- using the -- the particular multisystem approach, will those variants all show up on the plate?
A Yeah, B's and D's are very easy to distinguish.
Q What about Gc? Are there any rare variants to that?
A Oh, yes, a number of rare variants.
Q Will they all show up on the -- all show up?
A From the ones that we have seen, yes, they will. Now, there are some which are very close to others. In other words, some rare variants, you might have a difference. For example, there's one known as a Chippewa and there's

one known as aborigine. And they're very close together. And so you might have to go an isoelectric focusing to sort that out.

Q. If there were that problem when you're just looking at the plate -- well, which allele do they look like, first of all?

A. They look like their own. I mean, they're a rare variant, but the problem is to distinguish them between the two rare variants. You can distinguish them from the common types, but it's a question as to what name you put on the rare variant.

Q. So if you saw something on the plate that was rare, you know it was rare and --

A. That's right.

Q. -- couldn't confuse it with one of the common ones?

A. No.

Q. What about peptidase A? Are there any rare variants to that?

A. Yes, there are. I think there's one rare variant of that.

Q. And what's that rare variant?

A. It's probably the 3, just because it's the way they name things. It's very easy to -- that's got to be the next one that they name. So it's probably 3.

Q. Whatever it is, can it be distinguished using the mutli-system?

A. To my knowledge, yes, it can.

Q. What about a non-rare variant, the 8? Can that be distinguished using the multisystem?

A. No, it cannot. Only an 8-2 can be distinguished. But an 8-1 and an 8 cannot.

Q. Why can an 8-2 be distinguished?

A. Because the banding pattern is different from a straightforward 2. The 8 comes -- an 8-2 in fact looks like a 2 but with a slower band. But the 8-1 looks like a 1, and an 8 itself looks like a 2. So you need to go to another system for -- for sorting that out.

Q. If there -- okay. Well, in -- if you have an 8-1, then you're not going to be able to -- you're not going to be able to tell; is that right?

A. That's right.

Q. But if you had an 8-2 or an -- an 8-8, you should be able to tell by looking at the plate that you have a problem and then go to something else?

A. Well, an 8-2, you can distinguish that fairly clearly on -- on the plate. The 8 you can't. The 8 and the 2 look the same. The 8-1 and the 1 look the same. So, you know, they are just exactly the same, and you call them a 1, where in fact they might be an 8-1, but they're a 1 or an 8-1.

Q. What about the carbonic anhydrase?* Does that -- anhydrase Does that -- does that have any variants?

A. Yes, it has three.

Q. And can that be detected according to the multisystem?

*(phonetic spelling)

A. Yes.
Q. And with haptoglobin, using the -- the gradient acrylamide gel, does that have any rare variants?
A. Yes, it does.
Q. How many?
A. Approximately ten; might be some more.
Q. And can all of those be distinguished using the gradient acrylamide gel?
A. You should see some variation. As to whether you can tell exactly what it is, I'm not sure. You know, some of the variants are very similar to each other, and they -- it might be -- it might be not very easy to distinguish between variants. You should be able to distinguish a variant from a common type.
Q. Can it make a difference with -- with the gradient acrylamide gel what the concentration of acrylamides is, that is, what the variation in gradients is?
A. Sure, sure.
Q. Are -- is one particular one more sensitive than others?
A. Well, it depends on -- on the top level of -- the concentration of the top part of the gradient. If you go from, like, I think, the normal gradients are something like 5 percent to 25 percent, that should separate out everything very easily. There is another gradient which runs from 5 percent to 16 percent, and that -- at that point you can start losing some things

off the end of the plate. The -- the beauty of the gradient system is that you can run it for days and it doesn't go anywhere, where it just gets to its gradient and stops. If you try that with normal electrophoresis, you know, you're just going to lose everything on the end.

Q. Are there any things that can go wrong with -- with transferrin with a -- in -- in making -- in the typing of it?

A. Yes.

Q. What are those?

A. The most common thing that can go wrong -- and "common" is probably the wrong word -- but the thing that we have noticed most often that goes is when you have a degradation of the sample. And that starts -- you start seeing a ladder effect. Instead of producing only one or two bands, you start producing multiple banding.

Q. Does that end up in the -- when it degrades long enough with a shift of the band towards the cathode?

A. Yes.

Q. And it will reduce itself back to one band shifting towards the cathode?

A. Or two bands, depending on what you start with, yes.

Q. In determining whether or not you have any problems with a particular electrophoretic run, do you pay attention to how far the -- the enzymes go?

A. Yes.
Q. If you were to end up with -- with -- with bands in a position that was either too far or too -- too -- too short than normal, would -- would that alert you to that there might be some problems?
A. Yes.
Q. What kind of problems could cause that?
A. There could be a, you know, either an addition or a subtraction of the -- of something on the molecule to give you a different charge, in which case the mobility will be altered. It may also be -- just one of the most common reasons for alteration of or mobility is overloading of a sample. If you put too much sample in, then you then basically block or slow down the electric field to that sample and, therefore, everything doesn't move to the same degree as, say, a standard sample would.
Q. Can that cause unreliable typing results if you try to read --
A. If you try to read it, yes.
Q. Basically in that situation you should just -- your typing calls for -- should just be no -- no call at all?
A. That's right.
Q. In order to maintain reliability in general, does the forensic serologist need to be quite ready just to say, I can't type it"?
A. Absolutely.

Q I mean, that in fact is the biggest key to -- to making sure that you do have some sort of reliability; is that right?

A That's right. And that will come with experience, too. The more experience you get, the better you are at calling something that may be a little weak but, for people who are experienced -- and if you have any doubt at all, then the general rule is not to call it.

Q What kind of problems can you -- what can go wrong in -- in typing Gc?

A Normally what happens with Gc is that the protein breaks down and has a much faster moving mobility. That's not really a problem. It's just that you don't see anything in the normal areas, you just see things much more anodal to the main typing area.

(No omissions.)

Q. So in that sort of situation, if it's gone too far, you don't call it, no matter what it looks like?

A. That's correct.

Q. By the way, there is literature on the -- on the problem with transferrin that you mentioned; is that correct?

A. Yes.

Q. And that's a couple of articles by Dr. Ed Blake?

A. Yes.

Q. Are there any literature on the Gc problem?

A. I think the Gc problem was recognized a long time ago back I think in 1963 when they found that the protein was a little bit unstable, and in some bloodstain work that was done, the sample could not be typed, and I believe that they found that there was a faster-moving what they called a degradation band or something like that.

Q. And do you know where that was published? Do you remember?

A. I can find it.

Q. Would it help you --

A. Is it by Nerstrom?

Q. Huh?

A. Nerstrom is the author, one of the authors?

Q. I'm showing you a copy of the Home Office Central Research Establishment Bibliography on Blood Typing,

I believe -- Bloodstains.

A. Yeah.

Q. And page 58 of that.

A. Yes. This one here?

Q. Right.

A. Yeah.

Q. That's the article by Nerstrom?

A. Nerstrom and Skafte, Jensen.

Q. It would be in the Acta Pathologica?

A. Yes.

Q. 1963?

A. Yes.

Q. Is there -- what are the typing problems connected with peptidase A?

A. The normal problem we see with peptidase A is you normally get just a smearing. There's activity there, but it does not differentiate itself into bands, and so at that point you just don't call anything, because you can't make out any bands.

Q. What if you get smears in some bands? Can you reliably type from that kind of --

Q. I think you have to look at the sample and look at that a little bit more clearly. The best course of action at that point is to go back and repeat it.

Q. What causes that smear?

A. I'm not sure. We don't know whether it's a breakdown

9-3

of -- or it's just a lot of protein. It may be -- we see it a lot with vaginal swab samples, and it could just be from the vaginal secretion causing a lot of smearing. You see it more in probably semen stains than we do in bloodstains.

Q. What about with CA II? Are there any typing problems with that?

A. CA II, the only thing that you have to be careful with CA II is that CA I is also present and comes in approximately the same position as the CA II Type 1 band.

Q. Will the staining procedure that's -- well, excuse me. Will the antiserum that's used to develop -- I take it back.

A. You don't use antiserum.

9a

Q. I know. Will the staining procedure, the fluorescein diacetate, react both to the CA I and the CA II?

A. Yes.

Q. What do you do to prevent that problem?

A. You normally find that the CA II is a lot stronger than the CA I, and you just have to be aware of that problem and be careful when you are interpreting. Normally speaking -- excuse me. I believe it is -- it comes in the CA II Type 2 position, and the problem then is whether you have a Type 2-1 or a Type 1 with a CA I band.

9-4

Q. So if you just had a regular carbonic anhydrase Roman numeral II Type 1, you shouldn't have any problem?

A. You might see the CA Roman numeral I band in the 2 position, but a Type -- the only time you would confuse that with a -- or you should be careful of not confusing that with a Roman numeral II Type 2-1, which would have two bands; and in that case, the bands are of equal intensity.

In the previous case where in fact it is a Type 1, the bands are of unequal intensity.

Q. In semen, are there relative -- is both carbonic anhydrase Roman numeral I and Roman numeral II present?

A. There is carbonic anhydrase activity. We believe it is esterase activity, and there is no -- the CA II type is not reflected in semen.

Q. So if semen were being run in the multisystem Group IV and you got a result for carbonic anhydrase II, you shouldn't interpret that as a result?

A. That's correct.

Q. What problems are there in typing the haptoglobin using the gradient acrylamide gel where you use approximately four percent to thirty percent gradient?

A. None that I can recall. The only thing that you should be careful of is whether you have a degraded sample. In that case, you can use the transferrin as an indicator that you have a degraded sample. What

happens is you get a shift again cathodically in some of the haptoglobin banding.

Q. What -- what proteins can you reliably get out of -- of semen?

A. What protein?

Q. Right. I mean what polymorphic proteins can you type reliably from semen?

A. It is thought that transferrin is -- is present in semen, but it's in less quantity than you would find in blood, and the possibility is that you should -- that the same type that is reflected in a person's blood is reflected in his semen.

Q. But that -- the techniques for that haven't been developed?

A. Well, I don't know that they haven't been developed. The rate of occurrence of a variant in transferrin is very low. I would suspect that if you have a variant in a person, that it might be worth looking at in the semen stain of that person.

Q. Using the same --

A. Just using exactly the same technique. You might have to concentrate up the stain a bit, but that's nothing to do with this separation. That's just a sample preparation problem.

Q. What about the other red cell enzymes? Do any of those -- which one of those actually appear in semen?

A. PGM appears in semen. Peptidase A appears in semen. Glyoxalase appears in semen.

Q. Are those the three that can be reliably typed from it?

A. Yes.

Q. What about AK?

A. AK is present, but it's in very small quantities, and you would really just have to look at it and see what type you get. Again, you could use exactly the same types. It's there in such small quantities that probably you won't see anything.

Q. Can you reliably type semen for PGM subtypes using the isoelectric focusing?

A. Yes, you can.

Q. Are there any problems connected with PGM in semen that there aren't -- that don't exist when you're -- when you're talking about blood?

A. You have to be a little careful in that some semen stains will show greater activity of the primary gene product; in other words, in a Type 1, that will be the a band. In a Type 2, that will be the b band, but that should not be a problem. It just means that you have to be aware that that does exist.

You should be aware that it has been reported that when semen is mixed with saliva, you can get an alteration of the band pattern.

Q. What tells you you have that?
A. It depends on how far and how long that semen and saliva have been incubated together. There is a general shift, and you will see Type 1, for example, starting to -- the bands, being here, will start to move together, and you see just general slight shifts in mobility of the pattern; however, we find that if you use a reducing agent, that does not occur, so as long as you're using that, there should be no problem.
Q. Is that the same reducing agent, Cleland's reagent, or something like that, mercaptoethanol?
A. Yes.
Q. In PGM, it's been found that in fact there are four different alleles when at one point in time people thought there were two; is that correct?
A. That's correct.
Q. Do those four different alleles all survive equally long?
A. It is thought not.

(No omissions.)

Q. Do the ones that are denominated plus last longer than those which are denominated minus?

A. They are. That -- it seems to be a suspicion. However, that does not occur in all samples. We have seen one plus-one minuses degrade at the same rates. We have seen 1- bands degrade a little faster than a 1+ band.

Q. Would, in general, a 2- go faster than a 1-?

A. I think they are about the same, but, again, this will vary depending on the sample and the individual.

Q. Can that -- if you -- just taking a hypothetical example of a 2+1-, if you're just using the -- if you're using a multisystem where you don't do isoelectric focusing, can you have a situation where the 1- goes first and you're left with just a 2 band?

A. I don't think we've seen that on the -- on the conventional group system, say, for example, the multisystem. You still would see it looking like a 2-1. I guess if it was very weak there might be a situation where you would get a 2+ and you would -- you would get the 2 band but not the 1 band.

THE COURT: Counsel, I have a luncheon engagement. We can break any time.

MR. NEGUS: I was about to suggest that myself.

THE COURT: We're not going to conclude this morning, so we have to have you back at 1:30, sir.

THE WITNESS: Okay.

THE COURT: We'll resume then.

(Whereupon the noon recess was taken at 11:55 a.m.)

ONTARIO, CALIFORNIA; WEDNESDAY, APRIL 25, 1984; 1:31 P.M.

DEPARTMENT NO. 3 HON. RICHARD C. GARNER, JUDGE

(Appearances as heretofore noted.)

(Mr. Kochis is not present.)

THE COURT: Counsel, I want to compliment you on your promptness. The bailiff came to get me even before the appointed time.

MR. NEGUS: We have to wait for somebody, though.

(Whereupon Mr. Kochis enters the courtroom.)

THE COURT: Will you be using Exhibit 4?

MR. NEGUS: What is Exhibit No. 4?

THE COURT: I think that is the exerpt from the book. If you're not using it for a while, then --

MR. NEGUS: No. Well, I was -- well, let me -- how -- how about this. There's a few things I was going to ask about in that. Then I'll do it, and we can pass it up to you.

CROSS EXAMINATION (Resumed)

BY MR. NEGUS:

Q In the Exhibit 4, which is your chapter from the Imwinklereid book, you -- you give a certain procedure which you recommend as far as the sequence of analysis; is that correct?

A. In terms of semen identification or just in general terms?

Q General terms.
A I don't recall that, but, you know --
Q If you look at Page 900 to 901 --
A Oh, yes.
Q And basically what you are talking about is a procedure which will maximize the usefulness of tests in a situation where there is limited sample; is that correct?
A That's correct.
Q And basically what you recommend is that -- is it possible to type victims and suspects prior to starting on an analysis of the stains?
A If you have a limited amount of stain, yes.
Q And why is that?
A Well, it -- it enables you to maximize the usefulness of your typing. For example, there's not a lot of -- of use in doing a series of, say, six tests where the victim and suspect are all the same type, because if you get that type you don't know whether that blood originated from the victim or originated from the suspect. And what you want to be able to do is to try to find some system whereby they are different.

This also has the possibility of showing -- of eliminating at least one person that's donating that sample and possibly eliminating both people.

Q Let's take a situation in which you have -- where the suspect is not in custody. You have multiple victims,

you have stains with limited quantity in them, and from other sources you have a limited range of information about your suspect. For example, you had a semen stain from another state that you knew came from the -- from your suspect. Could you still adapt that procedure which you have outlined on Pages 900 to 901 to that particular situation?

A. To some extent. It would not be exactly the same, because, as you said, you don't have a suspect in custody, so you don't know what he is.

Q. Well, you may know limited things about him.

A. I may know limited things about him. For example, if you know from his semen that he's a PGM 2+ 1+ and his ABO type, you have limited information on that, certainly. And you can then decide on the size of your bloodstain as to whether you want to go after that or whether you would want to look at some -- some other particular system. It's -- it's sort of a -- it depends on the circumstances. You have to make judgment calls all the way along when doing the tests.

Q. Certainly. However, there's no disadvantage to maximizing the information you have before you actually start on a stain with limited -- where there's a limited sample situation?

A. No. It's a good idea particularly if you find a -- a bloodstain at a scene, there's a good indication that --

there's a good possibility, shall I say, that that blood came from the victim or victims. And if you have that information, you can maximize that and possibly find a couple of systems which were -- would enable you to differentiate at least between the victims.

Q. And just statistical information about the -- the incidents of the various alleles of the various enzymes and proteins in the general population can also allow you to pick the -- the tests which have the greatest degree of probability of picking up an unknown sample, too; is that correct?

A. That's correct.

Q. That is, for example, you -- you mentioned earlier that the AK system won't discriminate 90 percent of the -- of the people, whereas some of the other systems will -- will discriminate much -- much more highly. You wouldn't want to just run an AK alone on -- when you didn't know who the suspect was; is that correct?

A. Not on limited samples --

MR. KOCHIS: Your Honor, I'm going to be imposing an objection because I think we're starting to move not only far away from the Kelly-Frye issue as to the reliability but we're also starting to move far away from the reliability of the procedure Mr. Gregonis used in this case.

It's one thing, perhaps, if he didn't follow procedures that are accepted in the scientific community.

It's another thing if he chose to run a test for certain enzymes whereas someone else may have chosen another set of enzymes.

It's not a Kelly-Frye issue, and it's not a reliability of a procedure issue.

THE COURT: To some extent, this has taken on the appearance almost of a criminal deposition. And I suspect that Counsel is preparing for trial down the road.

MR. NEGUS: Actually, I was just preparing for the next motion with this particular series of questions.

THE COURT: Very well.

MR. NEGUS: I'm almost through. I mean, I think that was the last question.

THE COURT: I tried to, you know, along -- on the way I have given you some considerable latitude. I haven't shortened you. But I recognize that we are -- I can tell when we're away from that issue as well. So --

MR. NEGUS: I understand. I will admit, Your Honor, that this particular -- that this question that I have -- the last series of questions is really directed towards the Hitch issue rather than towards the Kelly-Frye issue. I thought as long as we had Mr. Wraxall here now, that one area I just wanted to cover, I would be wanting to have expert opinion on that when we get to it. So I just thought it would be easier.

THE COURT: I'll permit it. Go ahead.

MR. NEGUS: What was the last question?

(Whereupon the question was read.)

THE WITNESS: Answer, no, I would not.

(No omissions.)

Q. Under "Interpretation" on page 922 and 923, you list eight different points that are important for a forensic serologist to keep in mind when he is interpreting the gels that he develops; is that correct?

A. That's correct.

Q. Are those points points that are recognized in the forensic serology community as being important guarantees of reliability in using the methods that you do?

A. In general, I would hope that they would. I mean I don't know that everybody follows this list or has it written up on their wall. Not everybody, I'm sure, would follow it exactly to the letter, but as a general overall way of looking at interpretation, I would expect most serologists to follow these basic guidelines.

Q. As you state in the article, the possibility of misinterpretation can be minimized if in fact they are followed; is that correct?

A. Yes.

MR. NEGUS: I think I'm through then with reference to K-4. If you'd like to have that, I can fetch it for you.

Q. Can any polymorphic enzymes be detected in saliva stains?

A. Yes.

Q. Which ones?

A. You can detect PGM occasionally. It's not very widely reported, and, in fact, the incidence of how often PGM occurs in saliva is pretty small.

Q. Approximately what?

A. Well, I'd say probably less than about one percent. Of the ones that I've looked at and where I've known saliva to be present, the majority of times you don't see any activity from the saliva, but I have noticed it -- I know of one person who was a member of staff in my laboratory in England who reliably gave a PGM type from his saliva, but very few other people do that. I mean it is unusual.

Q. What about any other enzymes?

A. Well, there's amylase, of course, and there's a lot of it in saliva, and it has been reported recently that there is polymorphism in that amylase, but that is not routinely used.

Q. Can amylase polymorphisms be reliably typed?

11a

A. That I don't know. I think that's the question as to whether that is -- can that be reliably done. It's a fairly recent innovation, and it has been reported in the literature. I believe that in the literature, it said that it was done on stains, but I don't know whether in fact any studies have been done on that, and certainly I haven't done any, so I

can't report to you whether that's true or not.

Q. Do you know if the amylase polymorphism is -- has a greater frequency among certain racial groups than others, that is, the rare -- the rarer of the alleles?

A. I -- I don't know offhand. I can't recall that.

Q. Amylase 1 is the -- is the particular enzyme that's present in saliva; is that correct?

A. Yes; that's correct.

Q. The presence of -- of amylase in saliva, and particularly saliva stains, the particular test that you described where the property of starch and iodine, the turning in color, is used to detect amylase, is that test sensitive?

A. Fairly sensitive, yes.

Q. Approximately what dilution of amylase and -- excuse me. Of what dilution of saliva in whatever reagent, saline or whatever that you're using, will that pick up?

A. Oh, at least one in two thousand, I'd say, at least.

THE COURT: Counsel, could I get you to hold the thought there? They need me down in Department 1 for about 10 minutes, I'm informed.

MR. NEGUS: Okay.

THE COURT: All right. Take a brief recess.

(Recess.)

THE COURT: All right. Proceed.

11-4

Q. BY MR. NEGUS: The absorption-inhibition test, is that a sensitive test?

A. It's not a simple yes-no answer. I mean it's sensitive -- it's an adequate test for the job that it's designed to do. It really depends on your definition of "sensitive". It is not as sensitive as absorption-elution.

Q. Well, I suppose -- what -- for example, with saliva, what kind of -- how dilute a saliva stain can you have and still get a -- be sure you're getting a response?

A. In the -- because the levels of ABO substances vary from individual to individual, you should be using undiluted saliva to be sure that you're calling a non-secretor; however, if you have -- if you do the test and you find secreted antigens, then you know you've got a secretor, okay, and it could be a very dilute stain, and you could still pick up the secreted antigens.

Q. But because of the variations, if you're going to say "non-secretor" and you're just taking it out of a -- using saline to extract an unknown quantity of saliva from a stain, mere negative results on an absorption-inhibition doesn't necessarily prove non-secretor status?

A. That's correct.

Q. Even if you have amylase present?

A. Even if you have amylase present.

11-5

Q. One of the problems -- well, you mentioned that transferrin can get these bands and then eventually shift to the cathode. That's because sialic acid is being removed from it?

A. That's correct.

Q. And one of the common -- one of the common substances that's found in red blood cell membranes which will cause that removal of sialic acid is the -- a substance known as neuraminidase; is that correct?

A. That's correct.

Q. Does neuraminidase affect PGM?

A. Not to my knowledge. It depends on what you call -- you know, you ought to really think of it in terms of what concentration we're talking about, because I imagine that if you -- if you had enough concentration of neuraminidase, which would not occur naturally, of course, but if you put a large amount in, then you may get all sorts of things to happen.

Q. But if you just had a normal old wet sample --

A. Well, you know, you're going to get a little bit of neuraminidase in there. I don't know that that increase in -- that there is an increase in neuraminidase in a wet sample, and I don't know what sort of concentration that you would need for any adverse reaction to occur.

Q. If the neuraminidase were to cause an adverse reaction in PGM, how would that affect the result that you saw

on the plate?

A. I don't know. I don't recall seeing that experiment.

(No omissions.)

Q. Does PGM undergo deamidation?
A. I'm not sure.
Q. Generally, deamidation causes what sort of -- of changes in enzymes as far as their appearance on an electrophoretic plate?
A. I -- I -- I don't know the answer to that.
Q. On the Group IV that you do, you also look for G6PD and for hemoglobin; is that correct?
A. That's correct.
Q. Both of those have variations which are more -- discriminate better amongst blacks than amongst the other population?
A. That's correct. That's the same for both peptidase A and for all the systems on Group IV.
Q. So basically when you have a situation where you're -- where there's something -- some reason to believe that there may be a black involved, you use those to maximize your chance of discrimination?
A. That's correct.
Q. Can Gc -- can G6PD be reliably typed in bloodstains?
A. Yes.
Q. Can the various black variants of hemoglobin likewise be reliably typed in bloodstains?
A. Yes.
Q. When you type G6PD and hemoglobin using your Group IV, does that cause any loss of reliability with respect to PEP A or CA II?

A. Not to my knowledge.
Q. If -- well, the pH's that are used in the various groups are not always that which is necessary -- would necessarily be used if the enzyme was being typed alone; is that right?
A. That's correct.
Q. What they attempt to do is to find a pH which will -- which will work adequately, if not optimally, for all the different enzymes in the system?
A. That's correct.
Q. In a Group IV system, if one were to type for G6PD and hemoglobin, would one have to alter a pH of seven point four using an agarose gel and a TRIS/phosphate buffer?
A. No.
Q. Can polymorphic enzymes and proteins be typed from the roots of human hair?
A. Yes.
Q. If you just find a hair at a crime scene which has its -- which has been, as it were, plucked from a head, can that -- will that -- will one hair give you enough to -- to type?

MR. KOCHIS: Your Honor, I'm going to again interpose an objection. We're way beyond Kelly-Frye, of course, with hair folicles.

MR. NEGUS: Well, this is -- now I am actually using the witness as my own witness to establish a Kelly-Frye foundation for certain evidence that I'm going to be bringing

out.

MR. KOCHIS: The problem I have with that is --

THE COURT: Have you finished your cross examination --

MR. NEGUS: What?

THE COURT: -- Mr. Negus? Have you concluded your cross examination? You must do that before you take the witness as your own.

MR. NEGUS: Let me -- I probably haven't. Let me just --

THE COURT: Let's have you finish your cross, then Mr. Kochis to finish his direct, and then, providing we're not going to be too extensive, I don't mind the --

MR. NEGUS: It's not going to take that long. I don't --

MR. KOCHIS: Your Honor, the practical problem that we can save the Court some time if the Court was -- If I was aware of the nature of the evidence, I might be willing to waive a Kelly-Frye hearing on that particular issue.

THE COURT: Are you being premature in anticipating an objection that may never come?

MR. NEGUS: It's got to do with my Hitch motion, Your Honor, and basically --

THE COURT: If there's any doubt, let's go ahead. But let's conclude with the matter at hand first.

MR. NEGUS: Okay.

THE COURT: It's easier for me to keep straight if I

know the demarcation line.

Q. (BY MR. NEGUS:) You spoke of wet state versus dry state changes that -- that enzymes can undergo. What significance is that distinction in forensic serology?

A. When a bloodstain dries slowly and -- and therefore is a wet state type of stain as opposed to a bloodstain that dries reasonably quick, you can possibly get some forms of degradation processes occurring within that stain. That is the one that is slowly dried, whereas in a dry stain, that is, dried normally, you do not see the majority of degradation processes. You will get a degradation, anyway. In terms of that, you will just lose activity. With wet state, you possibly can run into other types of degradation processes.

Q. If you have whole blood that's just preserved in liquid form even with an anti-coagulant in it, can you have these wet state processes take place?

A. Yes.

Q. In the actual course -- well, most of the particular procedures that you have up there take what, three hours or so?

A. Totally together or -- or --

Q. For the run.

A. For each -- for each run?

Q. Yes, each run.

A. Well, some take -- Group I takes two and a half hours;

Group II, overnight; Group III, about three to four hours; Group IV, two hours.

Q. On the overnight run, the Group -- the Group II, that normally lasts what, about 16 hours, something like that?

A. Yes.

Q. The proteins on an overnight run are in a -- in a liquid state; is that correct?

A. That's correct, yes.

Q. If one's not careful about the heating or the cooling, I suppose, of the -- of the run, can you cause these sort of wet state changes just while you're doing the electrophoresis?

A. You can cause that within the EAP system, which is part of the Group II system. I don't think you can do it with AK, and I don't think you can do it with ADA. But we have seen heat problems develop in -- in the EAP system. But that's when it was normally run at a much higher voltage for shorter periods of time. And the higher the voltage, the more chance you're going to have heat problems.

With this Group II system, it's a fairly slow, leisurely run overnight where you don't have the high voltages and you don't have the -- the potential for heat problems.

Q. Can you have heat problems just from not having your cooling system operating correctly?

A. Oh, absolutely.

Q. And can that produce those wet state changes?

A. It can.
Q. If one has a heating system that is not operating correctly, is there any telltale signs that you will see on your plates?
A. Yes.
Q. What are those?
A. Probably goes off the end of the plate.
Q. What if its moderately not working?
A. Well, you will probably see, first of all, with -- with -- as the -- as you lower the cooling or remove the cooling, there's no heat dissipation. And, under those circumstances, the -- the enzymes as a whole migrate a lot faster. So you will get some impression, or at least you will see that your enzymes have moved a little bit further than they should. That would give you a -- a clue as to what may be going on. And then, of course, your controls, if they're showing heat degradation problems, then at that point you scrap the plate and do it again and check the heating system or cooling system.
Q. Could you also have situations where, like, in a plate where you use 12 slots, that some of them will go faster than others?
A. Yes.
Q. Is that also a sign of -- of improper cooling?
A. That -- that is possible, that what you've got there is a hot spot in the center of your plate and you get a

distortion, where the center portion of the sample, the center samples move faster than the outside samples. That also can be a function of bad contact with your -- between your plate and your -- your buffer.

(No omissions.)

13-1

Q Between the plate and the buffer?
A Yes. You have a sort of bridge which can either be a paper or a sponge contact; and if that contact is not even all the way along, then you get better contact, say, in the middle than you do on the edge.
Q So then what you're -- you mean between your plate and your tank buffer?
A Yes. Excuse me, yes.
Q Can that cause typing problems?
A Well, it can. It may. It may not. You just have to look at your controls.
Q When you're doing ABO typing, is it -- is it common to use negative controls, that is, controls which presumably don't have any stain on them at all?
A Yes.
Q Why is that?
A That is because you can find -- the ABO system is more susceptible than any of the other systems that we use in terms of spurious activity from other sources. The most common source -- cause of spurious activity is maybe perspiration, so you want to know -- and of course, a person who is a secretor would secrete his ABO blood group substances into perspiration; so if you have a garment with a semen stain on it and that garment is heavily saturated in sweat, then a good proportion of the areas of that garment will respond

13-2

to ABO typing and show the possible ABO type of the wearer of that garment. That then can cause misinterpretations of the ABO results from the semen stain.

Q. If you have background, that is, your negative control that shows some -- shows an activity from some antigen or another, what does that tell you?

A. Well, that -- well, it could be that, you know, you have some sort of contamination on the substrate. You want to know whether in fact the substrate under the stain under question contains the same contaminant, and so you would do a series of control areas right around the stain to see whether in fact that's all over it or not, and, again, it depends on the levels that we're talking about. If it's just a very small amount, then it's probably not going to interfere. If it's a large amount, then you may not be able to make any interpretation as to the semen result.

Q What about with blood, the same?

A. Blood, the same thing on the ABO system, yeah.

Q. Are the negative controls as equally important for the -- for the electrophoretic testing?

A. No.

Q. Why is that?

A. Because you do not see the same problem. We don't know of any -- we don't know that perspiration, or any

13-3

of those contaminants that could be found on clothing, causes any problems in enzyme typing.

Q. A person's -- could the -- could the sweat from an analyst himself cause typing problems with blood?

A. In terms of the ABO system, yes.

Q. In terms of the enzymes, no?

A. No; that's right.

MR. NEGUS: I have nothing further until I have some questions of my own.

THE COURT: Mr. Kochis?

MR. KOCHIS: Yes, Your Honor.

REDIRECT EXAMINATION

BY MR.KOCHIS:

Q. Mr. Wraxall, directing your attention back for a moment to the multisystem, and specifically with your Group I system, if a serologist chose, in employing your Group I system, to do the PGM and the EsD and not the GLO, would that procedure in and of itself have any potential effect on the reliability of the PGM and the EsD readings?

A. No.

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Q. Likewise, you mentioned on cross-examination that the starch, I believe, is placed in the gel for the Group I to help assist in the analysis of the GLO?

A. That's correct.

13-4

Q. If a serologist in using your Group I system simply looks for PGM and EsD, but uses the starch/agarose gel, is there anything wrong with that technique?

A. Nothing whatsoever.

Q. You testified this morning on cross-examination in response to some questions Mr. Negus asked you about, for example, a situation where you might not be able to find enzymes that are more hardy and detect the presence of enzymes that are less hardy, and the example I believe you used was PGM and EsD. Do you recall that?

A. I do.

Q. Does the actual concentration or quantity of the amount of the particular enzyme, for example, PGM or EsD, vary from one person to another person?

A. I'm sure it does.

Q. In a situation where in analyzing a given stain, you might detect the presence of, for example, EsD and not the presence of PGM, could that be a result of the relative concentrations of those two enzymes in a particular person?

A. That's a possible explanation, yes.

Q. Likewise, with your Group V system, if a serologist -- Group IV system. Even at this distance, I can see IV -- a serologist who would only use the system as to your PEP A and your CA II and not for the G6PD, would that

procedure in itself bear any effect on the reliability and validity of that person's analysis as to the CA II and the PEP A?

A. No.

Q. The -- the peptidase A 8-1 and 2-1 types that Mr. Negus talked to you about this morning, are those subtypes of any particular peptidase A enzyme itself?

A. They're not, strictly speaking, subtypes. They are a separate -- they are a response to a separate allele, but the 8-1 and the 1 are indistinguishable by the way that it's done here, okay, and so is the 8 indistinguishable from the 2 as by this technique and as by most techniques, in fact. You need to use a specialized buffer system; and even when you use it, it's not always very clearly separated. It's a very close separation that we have not gotten a good handle on in terms of separating the 1's and the 8-1's from themselves.

Q. Likewise, with PGM subtyping, is the subtyping a separate procedure that allows you to further differentiate between various PGM standard types?

A. That's correct.

Q. Approximately how long has electrophoresis as a technique been used to detect the various PGM enzyme types in terms of years?

A. Approximately 15 years I've been associated with it.

In fact, you know, I was certainly one of the first, I believe, to be using it. It was developed in the Metropolitan Police Laboratory in around about '66, '67. It was published in '68, and we had been using it for approximately a good year by the time it was published, I'm sure.

Q And how long have you been using -- how long has electrophoresis been used by your community to determine the various EsD enzyme types?

A EsD has been going since at least probably '75, I'd say.

Q And the EAP?

A EAP, that was reported in -- I gave a paper on that in I think '72. Let me see here. It was published in '76, but I believe I gave a paper in '74, or something like that; so it's been going a good 10 years, I'd say.

Q The AK and the ADA?

A AK and ADA were done before. They were back in 1970. They were certainly on line there, and AK was on line in 1968.

Q And when you use the term "on line", what is that referring to?

A Meaning that it was used routinely in casework analysis by myself.

Q And the serum proteins, the Gc and the transferrin,

how long has electrophoresis been used by your community to detect the various serum protein types?

A. The Gc, I was using that back in 1975, and perhaps a little bit before then. By this technique, though, a multisystem's a little bit different technique, but certainly it's been typed for, you know, nearly -- nearly 10 years.

And what was the other one you gave me?

Q. Both the serum proteins, both the transferrin, and the Gc.

A. Okay. The transferrin has not been -- it's been known for some time. I mean transferrin was reported back in 1957, but because of the low frequency of occurrence of variants in transferrin, it's not very often used, and so work on stains has only been going on that around in the order of about two years.

Q. With the Group IV system, those particular enzymes, the peptidase A and the CA II, how long has electrophoresis been used to detect those different types?

A. Both of those were reported in the literature in 1978, and I'm sure that they were being done in -- certainly when I left England, they were being done, '77, so it's probably been as far back as '76.

(No omissions.)

Q. And the haptoglobin?

A. The haptoglobin has been around for a fair amount of time, since 1966. It's been around nearly 20 years. Modifications have been made since then.

The gradient has been around since at least 1970, probably a couple of years before that.

Q. Is the period of time over which your community has used electrophoresis to determine these various enzyme types an indication to you as to its reliability and validity to make that determination?

A. Certainly. I mean, the longer that they have been in use, the more likely that, if there are problems that cause us to misinterpret that, those would have surfaced.

Q. Directing your attention to the chapter that we have introduced into evidence, the K-4 which I believe the Judge has, and I have an additional copy, on Page 901, the four criteria that Mr. Negus talked to you about after lunch as to considerations you often would take into account in conducting serological examinations, do you have those in mind?

A. Yes.

Q. And the fourth one, determining the genetic makeup of the victim and suspects in determining what type of case you're going -- what type of analysis you're going to perform, that, of course, assumes in a particular case that you have the luxury of samples from not only your victims but

suspect or suspects at the time you have to make that decision; is that true?

A. Yes. And that decision and in fact that determination is normally only done when you have limited sample. If you have unlimited sample, there is no need to -- in fact to determine -- there is no need to have both parties. I mean, you normally would like to have a victim because you want to see whether it's his blood or not. But you don't necessarily have to have anybody in custody or even, you know, suspected of being the assailant.

Q. And is it fair to say that, even with the best of efforts, enzymes and serum proteins do degrade with time, even they're dried -- even if the stains are dried and frozen?

A. Yes.

Q. So is there an interest, in a case where a suspect is at large and you're not aware as -- aware as to when or what period of time you're going to apprehend him and obtain a complete genetic profile, in starting to work on the stain?

A. I would -- I would take that approach, certainly, because it can then be used a potential evidence for including or excluding possible suspects.

Q. In a situation in which you have a known number of victims, for example, too and you have a possible suspect

and you're able to, through serological testing, obtain even a limited genetic profile, for example, of certain enzyme types, and you have a situation where the two victims and the possible suspect have the same enzyme type in a given enzyme, whether it's ADA or AK, is there still the need or the desirability for the forensic serologist in running a complete genetic profile of the stain, even though your one suspect or possible suspect and victims may have a particular enzyme type in a particular group? Or is the question too wordy?

A. It's a little wordy, because there are other things that might come into play there, you see, because you -- you gave the example of ADA and AK. Well, in that situation, you would be running EAP as well, and EAP has good discriminating probability as opposed to ADA and AK on their own.

Q. Let me ask the question real quick. If you have a potential suspect, would a forensic serologist, forensic scientist still want to conduct a complete genetic profile of the stain?

A. Yeah.

Q. And would a reason for that be to discover the possibility of other persons being at the crime scene?

A. Yeah. There is two possibilities. First of all, you can -- the possibility is that if you conduct that experiment and you find something that does not match a

particular marker in a suspect, then he is excluded as depositing that stain. If on the same analysis that stain could not have originated from your victim or victims in the case, then you have obviously got another person involved.

Q. Likewise, directing your attention to the factors that appear on 922 and 923 of your article, specifically, factor No. 7, where you mention that the opinion of a second expert is invaluable, do you have that in mind?

A. Yes.

Q. And by putting that in the pamphlet, did you mean to say that under no circumstances should a serologist ever make a call without a second serologist standing there looking at the plate?

A. No.

Q. The wet stain changes that may occur in a blood sample which is preserved, can those in part be alleviated by making a stain on a swatch such as a cloth and then freezing the sample?

A. If you -- what, before degradation occurs, you mean?

Q. Yes.

A. Yes, certainly. I mean, when you have a fresh sample, one of the good ways of preserving that fresh sample is to make a stain of it and freeze the stain after it's dried.

Q. Likewise, the wet stain changes that Mr. Negus talked to

you about shortly before he ended his cross examination that may arise, for example, with EAP or the other enzymes due to changes that may occur during a 16-hour run, if those type of changes would occur, would you expect those changes to manifest themselves on the plate on the standard?

A. Certainly.

Q. And is that one of the reasons why you use a standard?

A. Yes.

Q. Is photographing the plates a method of preserving the conditions under which the plate was run in terms of reliability and validity?

A. Yes, it certainly -- a photograph of the finished and completed run gives you or gives somebody else the opportunity to examine that and see whether in fact the standards are there and whether they are correctly separated and whether there seems to be any distortion on the plate or any problems with the plate.

Q. In your experience, are photographs always as clear as the actual plate itself?

A. No, they are not.

Q. Okay. Have you yourself had situations where you have photographed plates and you would not feel comfortable calling a particular enzyme type off of a photograph when you felt comfortable calling it off of a plate?

A. Yeah, many times. You know, when you have weak stains,

you quite often cannot see any representation in the photograph but it's quite clear on the actual plate itself.

Q. In a situation where that may occur, does the photograph still provide you any useful information as to whether, for example, any wet stain changes may have occurred during the photograph -- during the electrophoretic run?

A. Yes. As a general rule, you know, wet stain changes do not occur during electrophoretic analysis. It's unusual for that to occur. But certainly a photograph will give you an idea as to whether any problems have arisen in the course of the run or the development of the reactions.

Q. Will that include, for example, the band -- the banding patterns of the standard?

A. Yes.

Q. And where on the plate the -- the bands show up?

A. Yes, how far they are separated, in fact if they are adequately separated, if they've gone too far, if they've gone too short, whether there's distortion to the actual pattern, whether nice straight lines or whether they are bowed; all of this can give you information as to whether the plate was run correctly.

MR. KOCHIS: Thank you.

I have nothing further.

THE COURT: Anything else on cross, Mr. Negus?

MR. NEGUS: Yes, recross.

RECROSS EXAMINATION

BY MR. NEGUS:

Q One thing I forgot to ask on my first cross. In semen, can you get -- if you ran a semen stain on the Group I, would you get an EsD result? Is it possible to get an EsD result?

A It is possible to get it. The EsD occurs in the spermatozoa, normally, of the seminal fluid. And if you have a very good, high concentration of sperm, it's possible that you will see an esterase D result from the semen.

Q But that's considerably rarer than getting a PGM out of the Group I?

A Yes.

Q In determining the relative concentrations in a particular person of, say, EsD and PGM or any other set of enzymes, the key to making a determination as to whether the variation is in your plate or it's in the person would be to look at the standards that you're using on the plate; is that correct?

A Yes, that would certainly help, yeah.

Q Right. If -- if a standard, for example, if your -- if a standard person in your laboratory that was used for a certain particular -- for a particular purpose usually had a lot more PGM than they did EsD, and that all of a sudden you see them with a weak or disappearing PGM, you would

know you had a problem?
A. Yes.
Q. Generally, in photographing plates, the -- the -- there's three of them you do essentially using the flourescent properties of the -- of the stain; is that right?
A. That's correct.
Q. That would be the EAP, the EsD and the CA II?
A. That's correct.
Q. Are those photographs harder to do than the other ones?
A. Yeah. You normally need some filtering to go on it physically. It depends on how you're photographing. We photograph all our plates with a Polaroid, and it's very high speed film. And just because of that high speed of that film, you know that the reproduction is not going to be that superb. I mean, you know, you could get better results, I'm sure, by doing 35 millimeter and getting all the filters set up and so on and so forth. However, that's very time consuming. And, in the mean-time, you can get diffusion going on. So -- but even with a Polaroid, a black and white and high speed film, that normally works very well, but you need some sort of filtering, mainly to filter out the background ultra-violet that comes in there.
Q. Those problems, however, don't exist with -- with your -- with all the other stains, the ones that you just take in regular old laboratory light; is that correct?

A. The visible light ones? Not in terms of flourescence. You don't need -- you can use filters, but as a general rule you don't need them.

Q. What -- basically these -- these particular stains, they're -- they're sort of a dark blue for the most part?

A. Yeah. Most of the part from the glyoxalase, most of the reactions we use are a yellow -- ends up with a yellow background, and the enzyme activity, the areas of enzyme activity are blue.

Q. So you have a really nice black and white contrast?

A. Yes.

Q. Shouldn't be any problems getting it to come out just taking them by a regular old photo if you have it -- if the plate's developed correct?

A. Yes.

MR. NEGUS: I think that's the end of the cross.

MR. KOCHIS: There is no further redirect.

THE COURT: Take him as your witness on purposes of a Hitch motion, foundation, apparently.

DIRECT EXAMINATION

BY MR. NEGUS:

Q. Can you type polymorphic enzymes and proteins from a single hair root?

A. Yes, you can.

MR. KOCHIS: Your Honor, excuse me. At this point I

interpose an objection and I'd ask that he lay some foundation as to this witness's expertise as to that particular facet. It's in a field apart from the one we have been dealing with, which is body fluids.

THE COURT: All right.

Q. (BY MR. NEGUS:) Mr. Wraxall, using the same multisystem techniques that you use to do saliva and blood and semen, can you also types hairs?

A. Yes.

Q. Have you done that?

A. Yes.

Q. How many times?

A. Not very often, but I have done them, probably, maybe, a dozen or so times.

Q. Is there published literature on -- on doing that kind of work?

A. Yes.

Q. And have various reliability studies been done on enzyme typing in hair?

A. I believe so.

Q. Are you aware of that literature generally as well?

A. Yes.

Q. And from hair roots, is it possible to -- to get an ABO type?

A. It has been reported that you can. Some studies have been done over a period of years. And the first studies that

were done said that it was unreliable. I believe that the FBI have brought out a technique where they say it can be reliably done.

(No omissions.)

15-1

Q. Which technique do you use to do that?
A. That was the absorption-elution.
Q. What about enzymes? Can any of the enzymes that you use in the multisystem be reliably typed from hair?
A. Yes.
Q. Which ones?
A. This would only be in the hair root or the hair sheath. We don't know of any where the enzyme types are found in the shaft of the hair. It's normally where you've got some root around the bottom part or some material around the bottom part, and in that case you can do Group I and you can obtain glyoxalase, esterase D and PGM can be found. You're not necessarily going to get them all, but there's a possibility that they do exist. We -- I understand that you can find EAP and possibly ADA and AK. I don't think any work has been done on the proteins, and I, therefore, do not know whether they're there or not.
Q. Are you aware of like how much -- well, can you -- how many -- can you do one test from a single hair?
A. Yes, you can.
Q. I take it you probably couldn't do any more than one test?
A. No, because you in fact put the hair plus its root into the gel. Under electrophoresis conditions, all enzymes are probably moved out of there, and you then

15-2

stain it up for the ones that you're interested in. The most likely one to go for would be Group I because all three enzymes seem to appear in hair roots, but you can't take that hair root or that same hair and then subject it to another set of typing, because I think the enzyme is probably gone.

Q. Group I, if you use PGM without subtyping, esterase D and the glyoxalase, for a general population would have the highest discriminatory powers of all the groups; is that correct?

A. Yes.

Q. And that would include -- that would be for Caucasians, blacks, Orientals, Chicanos, whatever?

A. Yes, yes.

Q. Are you aware as to whether or not polymorphic enzymes exist in mucous?

A. Possibly. Anything that -- the enzymes -- a lot of the enzymes that we look at, not only do they exist in blood and semen, but they exist in tissue, so any sort of epithelial cells, possibly mucous, may or may not contain that enzyme.

Q. If you had epithelial cells in a substance that would turn out to be mucous, could you type it directly from the cells?

A. You could try. I mean I don't know that you would get it to work, but what you would do is to try it; and if

you got some activity, then fine. If you didn't, there's no result.

Q. Do you know if there's any literature on that as to whether or not that's a reliable process?

A. No. I don't believe -- I don't recall any literature on that.

Q. With the -- with the hair, how long can the hair be allowed to be kept in an unfrozen condition and still hope to get typeable results out of it?

A. You've got two problems with that, and it's not an easy answer. It can vary. It can vary from, you know, the next day you've lost enzyme activity up to possibly as much as nine months for the PGM. The esterase D and the glyoxalase I would think would be shorter. The problem that normally happens with hair or the root is that the root dries up, shrivels up and drops off, so you lose it, so you can't do anything with it.

Q. How long does it take for the root to drop off?

A. It depends on how firmly it's attached, and it really depends on how it's moved around mechanically, you know. If you take that hair and keep it somewhere and don't move it and keep it in a small place, then, you know, you're not -- you're probably going to be able to do enzyme typing a lot longer than if in fact you put it in an envelope and ship it out, for example.

15-4

Q. What range of variation are we talking about?
A. In what, in terms of time?
Q. Yeah.
A. Well, I've been able to group hair roots up to six weeks old. That's the extent of my best experience. I've also taken hair roots that have been fairly fresh and got no result. The only way you can really do it is to do the test is the way to do it. You should look and see whether there's any hair root to start with, and if it is -- if there is, it's my opinion it would be to do the typing as soon as possible. Even if you freeze it, I'm sure there's a possibility that you're still going to get it drying a bit, and it's likely to drop off when you try to remove it; so the sooner you do it, the better.
Q. If you were to do enzyme typing on a hair, would that in any way diminish the ability of a criminalist that does hair comparisons to -- to do his work?
A. Not as long as you're careful in that you don't mechanically crush it or cut it, but certainly one of the ways I do it is to stick the hair root into the gel, and if it's a long hair, just curl the hair up on the plate, run the test, run the electrophoresis, and before staining, remove the hair, and then you can go on and mount the slide and do the microscopic examination after that.

15-5

Q. If one were to get from epithelial -- if one were to run epithelial --

A. Epithelial.

Q. -- epithelial cells for Group I and were to get a recognizable esterase D result on your plate, running it alongside of your semen and your blood and everything else, would -- is there any other plausible explanation for the particular bands being present in the same spots as esterase D, for example, 1 bands would be when you had esterase D there that you know of?

A. If you got an esterase D 1 type, then whatever was in that sample that you applied is an esterase D 1. It depends on whether the epithelial cells are only epithelial cells or whether there is a secretion in there which has esterase D 1. Okay. For example, if you had a mixture of epithelial cells from the mouth and vaginal secretion, it may be that the vaginal secretion has given you the esterase D 1.

15a Q. What if you have a napkin that somebody blew their nose in?

A. If you get an esterase D 1, if you can be sure what that fluid is, you know, you can certainly indicate that that originated from a person who's an esterase D 1.

THE COURT: Are you about to conclude, Counsel?

MR. NEGUS: Getting close. I need to find one piece of paper here, I think.

Q. What if you were to do Group IV and to get -- well, can you get peptidase A and carbonic anhydrase out of somebody blowing their nose?

A. You might.

Q. If you were to get a pattern that was consistent with the peptidase A 1 --

A. Yes.

Q. -- would you be able to tell that?

A. Yeah, if it's a good pattern. Assuming that it's a good pattern and you interpret it as a peptidase A 1 type, then that originated from whatever you put into the gel.

Q. Just like any other body fluid?

A. Yes, yes.

(No omissions.)

Q So in putting body fluids into -- doing electrophoresis on different body fluids, what's important is whether you get the right pattern or not rather than what body fluids you're doing?

A That's right. I mean, first of all, you know, it's a good idea to try to identify the body fluid that you're talking about. And also you're assuming that it is not a mixture, okay, that it is uncontaminated body fluid. If it becomes, that is, as a peptidase A 1 or whatever enzyme type, then as long as it's a good, clear looking pattern, then you can conclude that that originated from somebody who is of that type.

MR. NEGUS: Thank you.

Nothing further.

CROSS EXAMINATION

BY MR. KOCHIS:

Q Mr. Wraxall, have you ever analyzed any mucous stains to determine, for example, PEP A type or carbonic anhydrase type?

A No, no, I don't recall doing that.

Q Any of the enzyme types with mucous stains?

A I have looked at saliva, you know, and that may be called mucousy. I don't know. It tends to be a little bit that way. But I don't recall looking at nasal mucous for enzyme typing.

Q. With the hair, the discussion that we had, for us laymen, what does a follicle consist of?
A. Well, I don't know the terms of -- I'm not quite sure of the -- the terminology. What I'm talking about is the sheath or the tissue in fact which adheres to the root bulb. Okay. The base of the hair that is implanted in the skin in fact is -- is a bulbous area, and around that there is a certain amount of tissue that comes out when you pull, particularly when you forcibly pull, the hair out. That part of the material is more or less the material that will give you the enzyme activity.
Q. For example, if you took a pair of scissors and cut someone's hair off, leaving the follicle intact, the -- the remaining hair you -- you could not do the enzyme typing?
A. That's correct.
Q. The same with the ABO typing?
A. Now, the ABO typing, they have been some work with crushing the -- the shaft of the hair and getting ABO results. How reliable those are I'm not sure. There has been some discussion over the years about reliability of ABO typing of hairs.
Q. You testified that you have -- well, have you done electrophoretic tests on hair follicles to determine the various enzyme types?
A. On hair roots, sir, you know, if that's the exact -- the

follicle part is what I have been testing. But certainly on hair roots with a certain amount of tissue attached, I have done that test, yes.

Q. And is that something you have done fairly recently?

A. Within the last two or three years.

Q. And is the use of electrophoresis with hair follicles or the roots, is that something that was developed after, for example, blood and the other stains, the other --

A. Oh, yeah.

Q. Is that something that's fairly recent?

A. Yes.

Q. And, in any event, once the follicle or root part separates itself from the hair, that ends your ability to conduct electrophoretic tests on it?

A. Yes.

MR. KOCHIS: I have nothing further.

REDIRECT EXAMINATION

BY MR. NEGUS:

Q. Just as a comparison, in terms of recentness, the hair has been, for example, around longer than the transferrin, is that correct, in terms of forensic work?

A. Probably about the same length of time, I'd say.

Q. There have been more published articles on hair than transferrin?

A. I think I know of only two on hair and only one on

transferrin.

MR. NEGUS: Okay. Nothing further.

MR. KOCHIS: No further recross.

THE COURT: Mr. Wraxall, thank you very much, sir, for coming down and helping us.

THE WITNESS: May I be excused, Your Honor?

THE COURT: You certainly may.

THE WITNESS: Thank you.

THE COURT: It's time for a recess. Do we have more witnesses?

MR. KOCHIS: Not today. We have Mr. Gregonis tomorrow to conclude redirect and recross, and he will be the last witness for tomorrow. I have Mr. Sensabaugh who is not available until Monday morning, and he will be arriving by airplane Sunday night. After he is done, Dr. Sparks.

THE COURT: Excuse me. Who is coming in on Thursday? That's tomorrow.

MR. KOCHIS: Dan Gregonis, Your Honor.

THE COURT: Just Mr. Gregonis?

MR. KOCHIS: He's the only witness. I hate to refer to it as "just Mr. Gregonis," but, yes, he's coming in tomorrow. And to orient the Court, it's --

THE COURT: I wouldn't think you're going to be very long with him, then.

MR. KOCHIS: I would think that is an accurate assessment of my redirect.

MR. NEGUS: I -- Mr. Gregonis, we're -- I'm predicting to Mr. Kochis we'll be done with him by noon.

THE COURT: Well, I need time in chambers, anyhow, on other matters.

MR. NEGUS: This is a particularly difficult motion, Your Honor, for Mr. Kochis in that the scheduling of people is not the easiest. Once we get into the Hitch motions and the other stuff where the people are all sitting over in the sheriff's department or doing things like that, I think you will find that the -- that Mr. Kochis is able to produce the witnesses much faster.

THE COURT: He is capable of speaking for himself.

MR. NEGUS: Just trying to help him out a little bit.

THE COURT: Counsel, I'm looking over and anticipating and preparing for the prior acts. In looking that over, I wonder if I could impose upon your office, Mr. Kochis, to dig out all of those pages of the Discovery and perhaps police reports on any of the priors that you intend to make offers of proof on that you are serious about presenting.

You refer in here to the Preliminary Hearing and primarily, however, to Pages, for instance, 160 and 161 of the Discovery and a number of references to the Discovery. And I don't have that. I wonder if you could perhaps make a package of things that I might read before I hear oral offers of proof.

This is on, you mentioned, pursuant to 1101b, and that

is not an enabling statute to present this sort of evidence, actually. You're actually presenting it to show common plan, scheme, intent, design, identity, that sort of thing.

MR. KOCHIS: Well, Your Honor, the practical problem we need to get into is -- you notice from reading both the motions that a lot of the factors that I mention in the 1101(b) motion we mentioned as evidence we intend to produce during the penalty phase, factors in aggravation.

THE COURT: This is offered strictly for the guilt phase, as I understand.

MR. KOCHIS: But there's two. Mr. Negus asked me to file two, and I did. And the problem we're at this juncture is Judge Kayashima wants --

THE COURT: Counsel, I'm fully aware of that. And I know that you have another one which I'm not looking at. I'm looking only at the one on the --

MR. NEGUS: They're identical.

MR. KOCHIS: They're identical. And what I'm saying is the practical problem is I suggest we turn perhaps to the statements in aggravation, because I think even Mr. Negus would agree that a number of things that may not technically be admissible under 1101 are certainly going to be admissible if we get to a penalty phase in terms of aggravating factors. And if the Court decides that, then he's going to make the claim that he should be allowed to investigate those.

MR. NEGUS: I'm not sure that that Judge -- I'm not

sure that we're going to be in a situation of investigation -- I think that we -- well, I'll have to go back and read what Judge Kayashima told me again, but my belief was that he wanted me to first of all get the -- get the question of 1101(b) straightened out. As far as investigations to take place in preparation for the penalty phase, we might not need to do that so quickly, and it might not even ever happen.

THE COURT: It seems like an excellent idea for us to have a hearing as to what is coming out in the guilt phase. So let's get a package together, if you can. If there's other things that he may need to investigate, then at least the time element is longer. If it's just going to come out in the guilt -- in the penalty phase --

MR. KOCHIS: I can try to get the package.

THE COURT: Okay. Then we'll break it until tomorrow at 9:30. Thank you.

(Whereupon the proceedings concluded at 3:02 p.m.)