UNITED STATES DISTRICT COURT

WESTERN DISTRICT OF TEXAS

SAN ANTONIO DIVISION

NO. SA-95-1215-EP

- -*

JEFF KAPCHE,

Plaintiff

VS.

CITY OF ANTONIO,

Defendant

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DEPOSITION OF DR. EDWARD HORTON, taken on behalf of the Defendant, taken pursuant to Notice under the Massachusetts Rules of Civil Procedure, before Kim M. Romaine, Notary Public and Shorthand Reporter in and for the Commonwealth of Massachusetts at the Joslin Diabetes Center, One Joslin Place, Boston, Massachusetts, on Thursday, May 25, 2000 commencing at 1:50 p.m.

APPEARANCES:

ON BEHALF OF DEFENDANT:

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I N D E X

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Exhibit Nos. 1-4 attached to original transcript.

P R O C E E D I N G S

VIDEOGRAPHER: This is the matter taken by the defense in the matter of Jeff Kapche versus the City of San Antonio held at the Joslin Diabetes Center in Boston Massachusetts on May 25th, year 2000 at the time indicated on the video screen. The court reporter is Kim Kelly of O'Brien & Levine and I'm Robert Kramer of Master Video Productions. Counsel will introduce themselves and the court reporter will swear in the deponent.

MR. GRIFFIN: I'm John Griffin. I'm from Victoria, Texas. I have the privilege of representing the plaintiff, Mr. Jeff Kapche.

MR. MORENO: I'm Luis Moreno. I'm from San Antonio, Texas. I represent the City of San Antonio.

THE WITNESS: I'm Edward Horton. I'm a physician here at the Joslin Diabetes

Center here in Boston.

(Exhibit Nos. 1 and 2 marked for identification).

DR. EDWARD HORTON, the witness, having been duly cautioned and sworn, testified upon his

oath as follows:

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EXAMINATION BY MR. MORENO:

Q. Good afternoon, Dr. Horton. My name is Luis Moreno, and I'm here on behalf of the City of San Antonio. Please state your name for the record again?

A. My name is Edward Shore Horton.

Q. And tell us where you reside and what your present occupation is.

A. Well, I reside in Brookline, Massachusetts. I am a professor of medicine at Harvard Medical School and vice president and director of clinical research at the Joslin Diabetes Center.

Q. Have you had your deposition taken before?

A. I have had depositions taken before.

Q. Have you testified in court before?

A. Yes, I have on one occasion.
Q. So you know when your deposition is taken, it's the same as if you were in court; you are under -- you are testifying under oath?
A. Yes, I know that.
Q. May I have deposition Exhibit Number 1, Doctor, and Number 2? I'm going to show you what

has been marked as deposition Exhibit Number 2 and ask if this is your declaration?
A. Yes, it is.
Q. Okay. Doctor, your primary work is in endocrinology and I guess diabetology?
A. Well, endocrinology and metabolism is the official name of the sub-specialty of internal medicine, but I work mostly in the diabetes area and diabetes related diseases.
Q. Have you had training or experience in occupational medicine?
A. Not training in occupational medicine. I've worked with many people with diabetes who are in different occupations and are familiar with some of the problems they face in their day-to-day

life with diabetes as it affects their occupation.

Q. Do you have any specific familiarity with the essential job functions and the job demands of a San Antonio Texas police officer?

A. Not specifically. Only in a general knowledge that anyone would have as to what police officers do.

Q. I had an opportunity this morning to review

your declaration, and I would like to ask you some questions with respect to the same.

A. Surely.

Q. You make reference to treatment protocol. Would you agree that a treatment protocol ensures capacity to perform or perform the same as -- perform a job the same as a non-diabetic? Is that the intent of a treatment protocol for an employee?

A. Well, not exactly. When we use the term protocol, what we're really talking about is a treatment regimen that an individual follows in his self-management and self-control of blood

sugar levels with his diabetes. It can be informal as in day-to-day activities or it can actually be a formal protocol that is mandated to allow a person to keep his blood sugar within a safe range while he is performing a certain task. So that the term protocol can be used in these two different ways.

In a general sense where you're talking about a treatment plan for a self-management or a more formal protocol which would be a defined regimen that a person would go through in order

to maintain their blood sugar in a given range over a certain period of time.

Q. But in an employment context, a treatment protocol was designed more to ensure capacity to do work rather than ability to do work, is it not?

A. The treatment protocol would not have anything to do with their other qualifications for a job, you know, training for a job. A treatment protocol for somebody with diabetes would be to provide a way to maintain their blood

sugar in a controlled range to avoid their blood sugar from being too low or too high so that they would not have any problems in carrying out their normal duties for which they would have to otherwise be qualified.

Q. The most significant of which would be incapacity from either hyperglycemia or hypoglycemia?

A. That is correct. What you really want to do is to avoid having significant low blood sugar reactions or hypoglycemia which if they occurred could impair judgment or capacity to perform certain tasks. That is really the most

significant problem that one would follow a protocol to avoid in a work situation.

Q. When you consider with a type one diabetic the matter of employment, would you agree that you would look obviously to first protect him from any harm and also protect him from harming others?

A. Those would be two things that would be of concern. With the safety for the individual, an

example might be somebody operating heavy equipment or where they could injury themselves or in a situation where they could injure themselves or harming other people that would be in the environment. Those would be legitimate concerns.

Q. And as a physician, of course you recognize some in a job duties involve higher risk work or higher risk work circumstances?

A. There are a whole spectrum of jobs that people perform that some would be higher risk to themselves as individuals or higher risk to others if they were not able to carry out their duties.

Q. And it's not only the job itself that is

higher risk but also certain circumstances during performance of their duties that are also higher risk?

A. Well, jobs vary tremendously from one minute next or one hour to the next if that is what you're meaning. There are certain -- in every job there are some situations which are

inherently higher risk than others. I would agree with that.

Q. Will a person who is in a job be at higher risk or otherwise be in danger if he for whatever reason is deprived of the means of adjusting his blood sugar level, that is to say, deprived of access to insulin or access to carbohydrates or glucose?

A. I think it would depend a lot on the circumstances. An individual who -- for example, if we're talking about somebody who is managing his diabetes by adjusting his insulin dose and his food intake and exercise, these are all things that patients are trained to manage themselves and it adjust themselves. One could conceive of a situation where if you deprived an individual of the ability to do this, there could

be problems. If you locked somebody up for a month and didn't let them eat anything or take any insulin or anything like that, but those would be very unusual circumstances.

Q. Hm-mm.

A. Reminds me of an example. I did have a chance to meet and interview an individual with insulin treated diabetes who was held hostage after the Iran situation and who was held hostage for about a year or longer and managed quite well with his diabetes even as a hostage over there.

Q. Did he have access to insulin?

A. With difficulty.

Q. Okay.

A. But he did it. The point is I can conceive of situations where it would be difficult to manage your diabetes if you were put in that kind of a circumstance, but I think it would be the most unusual circumstance.

Q. If you're deprived for whatever reason of the means to manage your blood sugar level, would you more likely face danger if you are on an intensive program or a tighter controlled program than if you were on a more conventional

controlled program?

A. No.

Q. Well, let me ask it this way, isn't the

purpose of a tighter control or intensive control program to keep the blood sugar level as nearly normal as possible?

A. Well, the goal for treatment of people with diabetes is to try to maintain blood glucose in as close to a normal range as we can in order that their average blood glucose stays fairly well controlled in order to prevent long-term complications of the disease. That does not necessarily mean that a person in a tighter controlled program is at greater risk for wide swings of blood glucose to the low range, hypoglycemic range or the hyperglycemic range. We see that occur in people who are very poorly controlled, you know, not on a tight regimen. And in fact, people who are on what we all an intensive regimen usually are well trained and manage their diabetes quite well. So that -- and many of them have actually fewer wide swings in blood glucose than somebody who was on a less intense regimen.

Q. But the person on a more intense regimen by

design seeks to keep the blood sugar level lower as a practice than a person on a more conventional program?

A. Well, again, what -- again, what you're trying to do is to keep the blood sugar in a normal range without having excessively low or excessively high blood glucose. So it's the swings in blood glucose that are important. I think it's important to realize that in a normal individual, blood sugar is going up and down throughout the day, and normally it's at its lowest point when you first wake up in the morning having fasted overnight. You eat a meal, it rises, comes back down over a period of two or three hours, you eat again, it goes up, and so blood sugar is always fluctuating throughout the day.

What we are trying to do when we train somebody with diabetes to manage themselves is to be able to duplicate as close as possible what the normal pattern of blood sugar, avoiding going too low or going too high. We can actually best achieve that by what people call intensive

management regimens, multiple daily injections, using a variety of types of insulin, learning how to eat a diet that will minimize wide fluctuations in blood sugar, learning how to manage changes in physical activity. So the three main things that an individual really has to be trained in and learn about is the effective different types of food, both amounts and types of food, the effects of different types of exercise, duration and intensity of exercise and how to adjust usually two and sometimes three different types of insulin in order to get this normal blood glucose pattern. It's really the less tightly controlled people that have the wide fluctuations in my experience that tend not to balance it so they're too high at some times and too low at other times.

Q. Would it be fair to say that the average blood sugar level of a tighter controlled individual would be lower than the average of those with conventional?

A. That is what we generally mean. We use a test called the hemoglobin A1C or glycyl hemoglobin to assess what average blood sugar

levels are. What this test measures is the amount of glucose that is attached to the hemoglobin in the red cells or the blood, and it gives us an index of what the average blood sugar is during the preceding two to three months. This test has actually become the goal standard for looking at how well controlled the average blood sugar is. It doesn't tell us anything about the swings, if it goes too high or too low. It just gives us sort of a two-month average.

Q. And it in and of itself doesn't tell you anything about the next six to nine weeks?

A. Well, only in the sense that we test this every -- roughly every three months in our patients. And if somebody is really stable or they may be coming down closer to normal, which means they are coming from higher average blood sugar to a closer to normal average blood sugar or if they're going up, we look at long-term trends. Now, nobody can predict what is going to happen in the future if there are major changes in the pattern, but most people are really quite stable. And one of the things that we are trying to do is to adjust regimens, work with people so

that they can bring their hemoglobin A1C into a range that we would consider to minimize their risk for complications.

Q. You refer in your declaration to a significant amount of research that is ongoing in diabetes care, but I wanted to ask about the direction of that research and what it still has not achieved. You would agree that it has produced abilities, as you've suggested, to monitor and to test blood sugar levels, but it seems to me that what it's missing is a duplication of the or the restoration, if I may, of the automatic functions that non-diabetics enjoy?

A. Well, the amount of research that is going on in the diabetes field covers a huge spectrum of areas. There is a lot of research trying to understand the fundamental causes of the different types of diabetes, type one diabetes and type two diabetes. There is a lot of research going on to understand the causes of the long-term complications of the disease and damage

to the eyes, kidneys, nervous system and vascular system. This is leading to better understanding

and development of new treatments and so forth.

Now, in type one diabetes, which I presume is the area that you really would like to focus on.

Q. Yes.

A. There are -- we now have developed methods to actually detect diabetes, the risk for diabetes before diabetes actually occurs in certain individuals. It's an autoimmune disease which means that the body develops antibodies that attack the insulin producing cells in the pancreas called bata cells. We can now measure these antibodies in the blood. That work was actually done here at Joslin several years ago resulting from studies where we are tracking families and family members of people with diabetes and discovered that you can pick up anti-eyelet cell antibodies, anti-insulin antibodies, a variety of other antibodies that are an indication that the autoimmune process has

actually started before there has been enough destruction of the insulin producing cells to actually result in clinical diabetes. You have to have close to 90 percent of the bata cells

actually destroyed before you get diabetes.

So this has lead now to a large national multi-centered trial funded by the National Institute of Health to see whether or not we can identify individuals who we know are at very high risk of developing diabetes within the next four to five years and see whether we can actually prevent or significantly delay the development of diabetes. So that is an area of research that is very active and ongoing here and other centers.

Another major area of research is the development of eyelet cell transplantation, being able to take the insulin producing cells from a variety of sources. They can be human cells, cells from animals that are grown in culture and they can even be genetically engineered cells. Cells for example that might be derived from skin, for example and genetically engineer them

to produce insulin.
Q. These would be introduced into the pancreas?
A. No. These cells would be introduced to the body usually not the pancreas. There are different sites that are used. The liver is one area, other organs where they put these cells.

And the trick is to be able to transplant these cells, keep them alive and functioning over a long period of time and prevent them from being attacked by the immune system and destroyed. So this is a very active area of research.

We are very much involved here at Joslin. We're part of a Harvard University consortium that is attacking this problem, and there is research going on at many centers around the world. So ultimately the hope is to be able to treat people with type one diabetes by eyelet cell transplantation and have these cells function in the body much like the normal insulin producing cells and be self-regulating. So that is another area of research that is very active.
Q. These eyelet cell transplantations although

are not presently available, are they?
A. Well, there was just a recent report from the group in Toronto that they have a number of patients that they are reporting on. There have been a number of previous reports around the world in various centers with eyelet cell transplantation. They problem is -- they work very well, but the problem is to get a long

enough effect. On average, these cells will function with current methods just a few weeks to a few months and then you lose the effect. I think about the longest survival eyelet cell transplant that I am aware of are about two years in duration. But a lot of research work is trying to understand how to -- when these cells are transplanted how to protect them, keep them functioning and so forth. So there is advance in this. A recent report from Toronto reported on half a dozen or so patients that they have transplanted there, and this seemed to be getting good effects. These reports are coming out all the time.

Q. Now, this research which allows you to determine that a person is a high risk for, say type, type one diabetes has not produced a means by which you can actually permanently prevent him from --

A. No.

Q. -- suffering the disease?

A. These studies or ongoing. The preliminary results are very promising that they can delay or prevent diabetes, but it's not going to -- it's

not a cure for diabetes once it's developed. Part of the problem is going to be how do you -- who do you screen. Currently we are trying to screen individuals we know are at increased risk so they would be first-degree relatives, either a or parent or a sibling or a child of someone that diabetes because we know the chances in that family are greater than just an average. But still the large majority of people that develop type one diabetes, it occurs with no other family history. So, you know, to make this practical, one would then have to go out and screen

everybody, and there are people working on inexpensive, rapid screening methods that may some day be practical, but this is not a practical situation at the present time.

Q. When you say cure, I think of the massive effort that was made in the thirties, forties and fifties if I recall correctly to cure polio which in fact is well known.

A. We prevented it. We didn't cure it. It wasn't a cure.

Q. You prevented it altogether?

A. Right.

Q. I imagine that is the frustration of endocrinologists that you have not found a way to prevent it.

A. It's interesting that you bring this up because I was a medical student in the 1950s and experienced as a medical student the last great polio epidemic in this country. They called us as medical students to come in and baby-sit, if you will, all these young people in iron lungs 24 hours a day who basically had polio. Your

example hits right home for me. I spent many long nights sitting up with young people who were affected in the last polio epidemic, and then when the affective vaccines were developed, it was a tremendous relief that we didn't have polio.

Q. I imagine you would feel almost equally ecstatic if you could prevent diabetes in the same way?

A. If we could prevent type one diabetes from occurring, I would be ecstatic. I have a son who developed type one with no family history, nobody else in the family, and I would be ecstatic if type one diabetes was no longer around.

Q. But certainly in the meantime, it is also desirable to find a means to automatically -- and this may be one in the same thing, to find a means to automatically, quote, break, closed quote, or put a break on the insulin introduction into the blood sugar level?

A. I think that we have -- and two, we have a way to actually prevent or, quote, cure the

disease. The term cure is somewhat artificial because eyelet cell plantation is not curing the disease. It's just introducing insulin producing cells. But until we have those methodologies, which everyone is working towards and hoping for, a lot of the research is on better ways to simulate what the normal pancreas does in the day-to-day regulations of insulin secretion and other hormones that are involved in this. The eyelets in the pancreas also produce glucagon which is another hormone that regulates blood glucose and that is also affected in people with type one diabetes.

What we are really trying to do is to simulate as closely as we can what the normal body does in the day-to-day regulation of blood

glucose. Blood glucose in someone without diabetes is regulated within fairly narrow ranges. The fasting blood sugar is generally between 70 and 110. It goes up above a meal and again it depends on how big the meal is and what is in the meal, but it usually doesn't go up much

above 140, 150 milligrams per deciliter and then comes down after that meal and may dip below the fasting level. It may dip down into the sixties, and you usually don't get any symptoms until your blood sugar gets down into the fifties someplace. So this fluctuation of blood sugar in a non-diabetic individual is generally in the range of, at the low point maybe 65, 70 up to about 140, 150 range. And so we are trying to develop methodologies and have been very successful in many ways, but not perfect of course, to allow people with diabetes to keep their blood sugars as close as possible to that normal range.

Q. Hm-mm. But again, you agree that the self-treatment is necessary or is the next best available means to simulate the non-diabetic's function because of the absence of mechanisms for the automatic production of insulin, the

automatic regulation of blood glucose levels?

A. Yes. In my opinion, the critical factor is to have a well educated and well motivated patient who really learns as much as he can about

what factors influence his blood sugar and how to appropriately control his blood sugar. And when we train patients and this is really a lot of what we do here is patient education, training and self-management and what we -- for people with type one diabetes who really have to take insulin, we have a number of ways to deliver the insulin that goes all the way from the old fashioned needle and syringe to the use of insulin pens which you can carry around in your pocket so you can take insulin any time you want to or need it or to use insulin pumps. There are a number of very good pumps on the market which are infusion devices which give a continuous fusion of insulin, and you can program them to adjust what we call the basal rate up and down as many as 24 times in a day. Then you control bolus, in other words, give yourself whatever number of units you want to cover meal time. And the things that are really critical for an

individual are, first, being able to monitor their own blood glucose as frequently as they

want to or need to, and this currently is done usually with obtaining a drop of blood with a finger prick or there are now some newer systems that you can do it on the forearm or other parts of the body where there are few nerve endings so it's not so uncomfortable. The traditional thing is to get blood from a finger, put the small drop on a little test strip with a meter which then actually determines the blood glucose concentration and gives you the reading usually within a matter of 15, 30 seconds, in that general range. And then you can take that information and use it to adjust what you are going to eat and how much insulin you take and so forth.

And the three things that we really train our people are, first of all, to learn how -- what their sensitivity is to a unit of insulin. In other words, one unit of insulin will lower the blood sugar by a certain number of milligrams per deciliter. So if you're high, let's say you start off at 200 and you know that one unit will

lower you by 30, 2 units by 60, 3 units by 90 or you may be more or less sensitive. So every individual has to learn how sensitive they are to make these corrections if they are too high or too low.

The second thing they have to learn is how much insulin to cover a certain amount of carbohydrate in their meal, how many grams of a carbohydrate. It doesn't matter whether sugar or starch or other sorts of things. They are all digested and absorbed as sugars. So it might be one unit for every ten grams of carbohydrate or one unit for every 15 grams of carbohydrate so we teach people to do what we call carbohydrate counting. They know what they are going to eat, they estimate how much carbohydrate they have, and they can judge how many units to take just to cover that meal.

And then the third thing they have to learn is the impact of physical exercise. Normally with physical exercise, your muscles take up sugar from the blood and burn it without the use of insulin. You don't need insulin for muscle to take up sugar, but the insulin affects the liver

putting out of glucose. So in a non-diabetic individual, there is a very close balance between sugar uptake in the muscle and the liver putting out sugar to balance. So blood sugar doesn't change much with exercise in a non-diabetic individual, but in somebody with diabetes, the insulin levels have to be low in order to allow the liver to put out sugar to balance it. So an individual has to know how to correct high or low sugar, how to take the right amount of insulin to cover what they are going to eat and how to make an adjustment of whether they are going to be exercising or not, and this depends a lot of type of exercise severity and so forth.

I work with a lot of diabetic athletes for example. They get very good at this, a marathon runner or tri-athlete.

Q. A marathon runner doesn't need a whole lot of insulin, does he?

A. When you are running a marathon, you don't need a lot of insulin. And this is the normal response. We have many marathon runners who can maintain their blood sugar in a very close range.

Q. It seems like a decent alternative to taking

a greater quantity of insulin?

A. People who are physically well trained and are good athletes, generally their insulin requirements are significantly lower than somebody who is a couch potato. That is very true. I've actually worked with people with type one diabetes who have competed, for example, in the Hawaiian Iron Man. That is a hard enough if you don't have diabetes, right? People with type one diabetes are able to complete Hawaiian Iron Mans.

Q. But all these people and particularly those who are on the intense program or who are very highly motivated are on a program that is continuously; you are continuously trying to recreate regulation of the blood sugar levels that are normal levels?

A. There is no holiday.

Q. There is no holiday?

A. No holiday. If you have type one diabetes, you have to be very dedicated to what you are doing. You have to check your blood glucose usually several times a day, you are making

decisions practically before every meal as to

what your blood sugar is, how much insulin to take, you may be adjusting what you eat and you have to make adjustments for exercise. So it takes a lot of knowhow, a lot of dedication to do it and it's not fun.

Q. And it's elementary to say that absent this daily patient intervention, you are constantly at risk of being unregulated in your blood sugar?

A. If a person doesn't pay attention, absolutely. Again, I'd just like to reemphasize the need for having the knowledge. So it's really the education and the training and self-management to be able to make these decisions throughout the day, and you have to be well motivated. So you have to really want to do it. And I think failure of regulation is often due too either a lack of the knowledge that you have and or a lack of motivation. You know, we see situations where people do lose their motivation. I mean, dealing with teenagers is not an easy job. I can tell you that.

Q. You mentioned --
A. I could give you some examples of difficult situations. Mix drugs and type one diabetes for

example, not fun. Teenagers, young women with anorexia nervosa or eating disorders, they learn that if they don't take their insulin that is a good way to lose weight. There's a number of really tough situations.
Q. In your statement on Page 4 you're talking about a particular product that you refer to as an implanted blood glucose monitor. I was just curious, you say that that works, that can work for 72 hours. And the question that I have is, is that designed for continuous use 72 hours upon 72 hours or just occasional use?
A. I don't think it's going to be -- going to find this in continuous use. I think it will be occasional use. This is a system that has been developed by the MiniMed people who are one of th major manufactures of insulin pumps. They have been working for a number of years on continuous glucose monitoring systems. What this is is a

small needle like apparatus that you insert under the skin. It has a little disc like thing with a needle sticking down, then a little wire which then goes to a recorder that you would wear on your belt for example. What this does is it

gives over 72 hour period a continuous monitoring of the blood glucose level. To me where this is -- and then you can download this and look at the patterns. Where this is really most useful is in looking at patterns of blood glucose. For example, if you have someone who is on an insulin pump or taking several injections a day and you really want to find out just what the blood sugar is doing between the times you would normally measure it because let's say you're even measuring four, five, six times a day, there is a lot of time in the day when you are not measuring it. So you want to find out how high somebody goes after a meal, do they go too low in the middle of the night when they're asleep. And so I think the real use of this is an occasional use to get a 72 hour continuous blood glucose

profile, then you can go back and look at, then make some adjustments in their basal insulin or their pump regimen to try to smooth out, then you could recorrect them again after you made the changes to see whether what you have done actually works. It's not something that I anticipate patients that I work with just doing

as a continuous way to monitor their glucose to substitute for finger-stick glucoses.

There is a lot of interest and the thing that patients also ask is when are we going to have a truly non-evasive glucose monitoring system. There is a number of companies that have been working systems that use infrared light or ultraviolet light that signs on the skin and it gets absorbed in the spectrum of glucose and then can give you reading on glucose. But these are -- technologically there's a lot of problems, they are not that accurate, you have to calibrate them to each individual. We are doing some research with some of these systems, but they are not ready yet for general use. So I tell all of

my patients you still have to stick your finger unfortunately.

Q. You refer in Paragraph 11 of your declaration to Humalog, and you discuss it in a context of covering a meal. I assume you mean in the case of Humalog being a fast or very fast acting insulin you mean covering a meal promptly. Why is covering a meal important?

A. Well, this Humalog has been a major advance.

It's only one of many new insulins that we have, but the treatment of somebody with type one to replace it, it's two concepts. One is to replace what we call basal insulin which would be the amount of insulin that would be coming out just under basal conditions overnight or between meals or if you skip a meal. You know, the fasting levels. And the other is what we call bolus insulin which is trying to reproduce what the pancrease would normally secrete in response to food intake. So you eat something and almost immediately there is a burst of the insulin that comes out and then it falls off over time, and

then it goes up very rapidly and then it begins to fall and the blood sugar rises and then falls down. So what you want is to cover a meal, meaning to give a very rapid acting, short acting insulin which is absorbed rapidly since you are giving it by injection and then doesn't last too long because you want it to cover that food but then be gone so you don't have too much insulin around three, four hours after the meal when you don't need it because that could be associated with going too low.

We had in the past the short acting insulin has been what is called regular insulin which is normal insulin. It's absorbed a little bit slowly because when it comes out of the bottle it's in what we call a hexamer which is six insulin molecules stuck together in a crystal. You inject it, it has to break down from this hexamer to a dimer or just two molecules which then get absorbed and then they disassociate into the single insulin molecule. Now, this takes a period of time so somebody taking regular insulin

generally has to allow 30 to 45 minutes for this process to occur. So we tell people to take their insulin injection 30 to 45 minutes before they have a meal. Well, first of all, that rarely happens. People don't do that. It's just not convenient. It doesn't work. You are going out to dinner and you are not sure when to take your insulin because you don't know when your food is going to arrive. You are not even sure what you're going to eat, and you haven't even figured out what is going to be in front of you. So Humalog insulin is a absorbed -- it's a modification of the insulin molecule so it

doesn't form these hexamers and it's rapidly absorbed. So you inject it and you got the effect within minutes.

It's just revolutionized the life of people. They don't have to take it until the food is right in front of them and then they can do their carbohydrate counting, they know that they are going to eat, they know they are going to eat within a couple of minutes and so they can check

just take their bolus. And then the other thing is that it -- regular insulin lasts longer than it should because again, because of the absorption and clearance is longer and slower. So this stuff is much more like the pancreas normally does. It's rapidly absorbed and gone more quickly.

Q. If you're eating your largest meal of the day and you injected Humalog, this rapidly acting insulin or let's say one or the other Humalog or the regular acting, short acting insulin and if your meal has been served to you and you've injected one or the other and you are that person in the American Embassy in Iran and they burst in your on meal, you prefer at that moment to have

injected regular versus Humalog?

A. You would prefer to have something to eat I think.

Q. You want to hope that the hostage takers are not hungry and take your food away?

A. Yes. I think it's obvious you'd give yourself a does of rapidly acting insulin if in

anticipation of having something to eat. It's much better to be able to do it right before you eat than it is to try to anticipate by 30 to 45 minutes.

Q. A lot of these developments in insulin and care really address the notion of keeping your blood sugar level from going up in such a way as to produce diabetic complications?

A. Yes, and also to prevent low blood sugar because of the timing. It's like the old saying, timing in life is everything. The timing of coordinating your insulin with your food intake and the changes in your blood sugar is really critical. So if your insulin is too low and too late, you may go to high after a meal. If it's too late and you have too much insulin four, five, six hours after a meal, you can go too low.

So it's really trying to match the insulin with the changes in food intake and the need for the insulin which is what your normal pancreas does without you even thinking about it.

Q. In discussing the matter with Dr. Ralph

DeFranco in his deposition, he suggested to my surprise that having insulin to cover a meal was of a higher priority than having a meal to cover insulin. What do make of that?

A. I think that the -- this is the strategy of what we are trying to do is to allow people to lead a normal life and do what they want to do. So this is -- it's a paradigm. In the old days, in the beginning, people were trained to adjust their food intake, to adjust their exercise, to adjust their insulin. Basically they were tried kind of to their insulin regimen. Now the whole idea is to try to balance what you take for insulin, what you take for food, what you do for exercise to allow you to flexibility to do whatever you want to do to, skip meals, to take extra meals between times, to exercise when you wants to. And again, I bring up the athlete paradigm because I work a lot of athletes, and

I've always been very much interested in athletic performance of diabetics. I tell people that you can do anything you want. I've worked with

people who are professional athletes, I've worked with people who are just weekend warriors, if you will. And people really can learn how to balance their insulin, their food intake, their physical activity so that they can do these things.

One of the -- I used to say the only thing I worried about somebody attempting would be something like scuba diving. And I made this statement at an international diabetic athletes association congress, and immediately a group of about ten people jumped up in the back of the room and started yelling at me and telling me that I was crazy, that they scuba dive all the time and so I got interested in it. We actually got Patty to -- you didn't used to be able to get certified as a diver if you took insulin, but we got that changed and you can now get certified. We have also worked with divers to get the latest information for people with diabetes who are divers. So that's just an example of where even I thought at one time there may be certain things

you shouldn't do, I found out that there are

people out there doing it and they figured out how to do it and they do it just fine and it works well.

Q. You're referring in your declaration to employment protocol. I think you said in addition to the technological advances, in recent years there have been a number of employment protocols developed for people with diabetes who take insulin.

A. Yes.

Q. What type of work have these employment protocols been developed?

A. Well, I can just tell you my own personal experience because I have worked with some of these groups. The first group that I worked with -- I was part of a blue ribbon committee that was put together by FAA to work with the issue of air-traffic controllers. Under the Regan administration it was decided that any air-traffic controller that was taking insulin should not do that. They were taken off the job. Many of them had been on the job for many years with no problems, but they were removed and

assigned to other duties. So I was part of a committee that sat down and reviewed the job requirements, actually visited the FAA, got to go into the master control room which was interesting. Talk about 1,000 points of light. It has every airplane in the air in the United States on one big screen. So I spent a lot of time learning about what air-traffic controllers do, what the requirements are, and we came up with a protocol to get the air-traffic controllers back to work which involved checking their blood sugar before they went on duty, at certain periods of time during the course of their work, having appropriate reactions if their blood sugar was too high or too low and we allowed safety margins. I think we set the lower limit at 100 rather than 65 or 70 and I think we set the upper limit at around 400. So we developed this protocol which then was reviewed and actually put into effect, and the air-traffic controllers went back to work. So that's one example where you could do that.

The second thing that I worked on was another panel that was convened by FAA to look at

waivers for third-class airmen or private pilots basically, and we reviewed with the FAA the requirements for what a pilot does to take off and landing and flying and all these things. So we actually developed a protocol that would allow people to do that. The big difference between the FAA and the pilots was the FAA, there's always -- you're in a group setting and there is a supervisor who can kind of look over your shoulder and make sure you do it, but if you're private, you're on the honor system, right? So it's kind of worked well. And I think that the FAA reviewed all that, put it out for public comment, and I think that that's been implemented now.

The third area has been in the area of commercial vehicle drivers, and this has been kind of an on again, off again sort of program. There was a test or a pilot waiver program, research project, if you will, to look at interstate truck drivers who take insulin, and they've collected the data from that. I haven't seen the absolute final report, but my understanding is that they found that people who

were taking insulin well controlled actually had a lower accident rate than average in those studies.

And the Federal Highway Authority is actually studying now, coming up with what their final protocol and recommendation is going to be and actually served as a consultant. Last fall I went down to Washington, was invited to be part of a panel to review the situation and make recommendations and so I did that. I think that it's not -- they have not come up with their final decision yet as how they are going to handle that. But those are three areas.

I've also had patients of mine who are police officers. I have one individual that is a police officer. I've worked with other people who are, you know, potentially high risk occupations. While you wouldn't consider a high risk occupation, I consider my work with diabetic athletes to let me know what you can do. And I think to me, working with the athletes has really been very instructive because you take first of

all, there is generally high motivation, people are checking themselves, some of them many times

a day. They learn how to make the changes on a rest day, a training day or a competition day, all of which are very different situations so they really learn how to deal with changing situations. I think I've come away realizing that a well motivated individual can do almost anything they want.

Q. In consulting with the FHA on the commercial vehicle driver waiver program, did you have an opportunity to review the specific requirements of what a commercial vehicle driver does?

A. Not in great detail. I mean, we were given background information about long-distance hauls, you know, how many hours you have to be up and things like that and also some of the physical requirements that you have in terms of possibly loading and unloading trucks and things like that, but I wouldn't say that we spent a great deal of time learning all the fine points of it. Not to the same extent that I learned the fine

points of what you have to do as an air-traffic controller or as a pilot.

Q. You feel that even now, even today, months later you could articulate what an air-traffic

controller or a pilot does?

A. Well, this is six or seven years ago, but I think there the focus was on mental alertness and quick response time and managing multiple different situations but not so much physically demanding work obviously, but it's really most mental alertness and attention to detail. I think it's almost the same thing with the pilots. It's really the risky times of being a pilot are takeoff and landing but you have got to -- so it's really certain times that you have to make sure that your blood sugar is in the limits where you function completely normally.

The only other experience I've had in this area from a kind of legal point of view -- I just might mention it -- is I have reviewed some -- at least one situation of a flight attendant, airline stewardess or flight attendant who had

type one diabetes and there was some question by the employing airline as to whether or not a flight attendant would -- taking insulin would be prepared to act in an emergency situation. So I was involved in some discussions about that as well.

So there are a number of these situations that come up all the time in terms of the employment environment, and the position that I feel very strongly about is that it really involves an individual assessment of the person, how well controlled they are, how well educated they are, do they have any physical complications or things that would preclude them from doing a job. Obviously there are certain things that -- there could be physical limitations to doing a job. You have to be meet all the other requirements. But in terms of blood glucose control, one with a well educated and well trained person and who is well motivated can really avoid these risks of hypoglycemia or severe prolonged hyperglycemia.

Q. So you have consulted in the air-traffic controller circumstances, pilot circumstances, to a lesser degree with commercial vehicle drivers. I know what I was going to ask you. Was that flight attendant's circumstances a matter in litigation or --

A. Matter of litigation, yes, it was.

Q. Have you ever consulted with respect to the

department of employment protocol in any type of law enforcement work?

A. No, I have not.

Q. I --

A. Prior to this.

Q. I understand. You mentioned you have a patient that is type one diabetes who is in law enforcement. What -- if you don't mind telling me, what department does he person work for?

A. He is a police officer in one of the regional cities here.

Q. I see. And does that regional city have any type of employment protocol that it imposes on your patient?

A. No. Not a formal protocol like check your sugar now, eat this sort of thing now, no, they do not. This is -- I've just worked with him. He's a very highly motivated, well educated individual and I've just taken care of him and I know that he's able to carry out his duties as a police officer.

Q. So insofar as a safety issue is concerned, you involvement is on the patient side as opposed to the police function side?

A. That's right.

Q. You mentioned the Department of Transportation commercial driver license situation. I understand that at some point in time during the nineties they changed -- the department changed its policy to allow type one diabetics to perform non-commercial driving. Are you familiar with that change?

A. No. I'm not sure what you're referring to there. What do you mean by non-commercial?

Q. Well, apparently they have a distinction between one type of driving and the other. I

imagine it has to do with what kind of vehicle that you drive.

A. I'm not aware of that. You know, the distinctions that I have generally been aware of or without knowing the details are one can get an ordinary driver's license if you have type one diabetes to drive your personal car or whatever. I believe that one of the big distinctions is whether you're a driver in interstate commerce or locally. So that is basically the difference, local state regulations or local regulations versus federal regulations. So the only area

that I have been involved with has been in the federal area which really has to do with interstate commerce commercial driver's licenses, but I don't know any subgrades of that.

Q. You mention, Dr. Horton -- well, you mention studies and you mentioned a Department of Justice action in Arizona and North Carolina. Are you aware of any other studies or Department of Justice rulings compelling the employment of type one diabetics or the use of employment protocols

in any other type of higher risk work?
A. Not beyond the ones I've mentioned to you already. I mean, the ones that I'm aware of that I have been personally involved with.
Q. Yes, sir. In Paragraph 13 of your declaration, Doctor, you say that, "As a result of the development and improvement of diabetes technology and treatment protocols, people with diabetes are much better able to self-monitor, self-control and self-treat their diabetes and can be anticipated to lead long and healthy lives without long term diabetic complications." When you say better able, essentially a diabetic today appears to be better able to do or undertake the

same basic treatment steps that he undertook 10 or and 15 years ago?
A. Yeah. But the tools are much better.
Q. The tools are better but the actions necessary are still the same?
A. The actions in the sense are the same in that a person has to -- if they have type one diabetes, they require insulin and the way it's

delivered now is either by injection or with a pump. It's all different ways to inject it, whether you use a needle and syringe or a pen or continuous infusion device, what have you. So yes, people have to take insulin from outside. The people now can adjust -- I think frankly the biggest improvement of all has been the self-glucose monitoring.

Back several years ago we had people collecting their urine and boiling it to see if it turned colors depending on how much glucose was in it, and then we finally got dipsticks that you'd dip in it and it would turn colors. That dipstick told you that there was sugar in your urine and a lot or a little. It didn't tell you anything about what your blood sugar was doing

when and these ups and downs and it was always after the fact because what your urine was measuring what was in your bladder which was what was in your blood a few hours ago. It was -- it really it helped a little bit, but being able to actually do a finger stick, see what your blood

sugar is and then make a judgment about insulin, how much you're going to take, what you're going to eat, whether you have to get your sugar a little bit higher if you are going to go out for a five-mile run and if you went a little cushion. These are the judgements that are now possible. So it's totally different ball game now than it was 10 years ago or 15 years ago. It's basically because of technology.

Q. But 15 years ago you could make the same judgments. Perhaps you couldn't make them as -- would you agree that it was really the ability to self-monitor that changed everything?

A. I think so, Yes, plus the fact you have much better insulins now. We have very short rapid acting insulin. We also have better basal insulin. The FDA has just approved, and it's not on the market yet but will be soon, a new basal

insulin which is a long acting, once a day injection that people will be able to take at bedtime.

Q. You said injection?

A. Yes.
Q. The same as --
A. It's an insulin injection, but it's just very predictable, long acting 24 hour insulin for the basal treatment instead of twice a day insulin. So all the time we are getting technologically better insulins. We are getting more convenient and more rapid ways to measure blood sugar. We are getting better ways to administer the insulin. So these are just technological advances. But you're right, it's all still based on you have to take insulin, you have to know what you're eating, you have to know what exercise does. So it doesn't get away from the hands on, day-to-day involvement.
Q. Going back to your police officer, you have one police officer --
A. That I can think of just off the top of my head.
Q. Do you recall treating any other law

enforcement type person recently?
A. Not recently, no.

Q. But say you've --
A. Well, we're talking about type one diabetes specifically?
Q. Yes.
A. Not with type one. I have other people. I just happened to think of one other individual who works in the drug enforcement area which is probably higher risk than being a police officer but he has type two diabetes.
Q. I see. Okay. Staying on your police officer a little bit longer, did you have an opportunity to learn from him about his actual day-to-day experience? Could you tell me for example whether he has ever fired his weapon while on duty?
A. Well, I can't tell you that detail. I mean, I talk to all of my patients obviously and find out what their day-to-day life is like, and I know he is a patrol officer, he responds to emergencies, he gets called. Whether or not he's actually fired a weapon, I don't know.
Q. You mentioned drug enforcement work being

higher risk than perhaps police work.
A. Well, that is my guess.
Q. I'm glad that we're in a position to guess and not really know. Assuming that to be the case, is it desirable to have an employment protocol for a type one diabetic in those circumstances?
A. Well, you know, with my opinion I think that a well trained and highly motivated patient is going to follow his own regimen and the regimen needs to be individualized a great deal. The problem with a protocol is it says you do A, then you do B and if B is such and such, you do C and that is almost too rigid for me. I really think that highly a educated patient, well trained makes decisions himself or herself based on blood glucose readings, anticipated exercise, anticipated food intake, correction for blood sugar if it's too high and these things you can't write in a protocol. You can't -- it's not a cookbook operation.
Q. And they're all designed to keep the blood sugar level within an acceptable range?
A. So I think what do if you write a protocol

is basically to write a guideline and say you should keep your blood sugar in such and such a range. And I do think that it's perfectly reasonable to have a safety cushion, if you will. I mean, we did this with our patients -- I mean the people for the air-traffic controllers and the pilots saying that you shouldn't get your blood sugar below 100. If it is below 100, here is what you do, you take something to eat. The other kind of protocol if you want to call it a protocol is you have food available with you at times so that you can take food if you need it. Everybody is trained to pick up symptoms if their blood sugar is getting low and taught how to take appropriate action for it. And all of these things I would rather call guidelines rather than rigid protocol. To me, a protocol almost implies a very rigid thing and I think what you need is flexibility. You need guidelines.

Q. It certainly puts a greater responsibility on the patient?

A. It does, yes.

Q. As opposed to the employer insofar as --

A. But when you think about it --

Q. Risk is a concern?
A. But when you think about it, it's a little bit unfair to put the responsibility upon the employer and say, you have to follow this guy around and make sure he's doing this all the time. It really should be on the patient's responsibility or the person's responsibility.
Q. I'd like to discuss a little bit more the experience that you have with the -- actually, experiences that you had with the Federal Aviation Administration. If I understand you correctly, you were first on a blue ribbon panel of distinguished endocrinologists that worked with the matter of or the matter of air-traffic controllers with type one diabetes and then also considered the matter of issuing of license to pilots, if I understand correctly, third-class airmen. Let's talk about the service that you had with respect to the pilots. If I understand correctly, that was a several year process, was it not?
A. Well, at least a couple of years that I was involved with it.

Q. But the FAA considered it, if I understand

correctly, from 1991 to 1996?
A. Well, my involvement was in 1991 to 1993, if I remember correctly, when they were really beginning to consider this, and we met and developed some guidelines for them. Then the process involved coming up with their own guidelines, publishing them in the record for comment and this whole -- I really was not very much involved from that point on. So it was really next development of the original recommendations that they then considered and then they published and went through the whole commentary period and finally came up with their final thing. So I guess I was probably in early but didn't follow it all the way through.
Q. But you were chairperson of that -- chairman of the committee?
A. Yes, I was.
Q. And --
A. It was also at the time that I was making my move from University of Vermont to here at

Harvard and that was 1993 when I came down here so I was kind of trying to finish that up and get on with my new thing so I didn't really have much

involvement after that point.

Q. Okay. Did your committee prepare a report for the FAA?

A. I did, yes.

Q. What recommendations did the committee make?

A. Well, we made an -- I was actually last night trying to find a file to review the details, but I couldn't find it. I think it's packed away in Burlington, Vermont someplace. I cam summarize in general terms. It may not be exactly 100 percent. The recommendations, first of all, were that the person had to have a regular physical examination and pass all the physical requirements, eyesight, neuropathy, you know, they had to be in good health so they met all the general physical requirements that you'd require for third-class airman's license.

The second thing had to do with the need for having documented a training program in

self-management, good education programs, being trained in self-monitoring of glucose, being trained in being able to recognize and take appropriate action for symptoms that might be associated with low blood sugars.

And then we set up a protocol that we felt would ensure that an individual would maintain their blood sugar in the range of approximately 100 to 400 milligrams per decaliter. This involved the requirement that they would do a finger-stick glucose before they were getting ready to take off, and if it was below 100 that they would take something to eat and that they would wait for 30 minutes, then recheck to make sure that it was in the right range. Likewise, if they were above the upper limit of 400 that they would either wait if it was just matter of being too high after a meal or they would take extra insulin to bring it down depending on the circumstance and recheck. So at the time that they were ready to take off, which is considered a critical time, that they would be in that range

of 100 to 400.

Then we recommended periodically and I can't recall the exact finding, but like every two to four hours or something like that while they are actually up flying and that they would also check when they were getting prepared to land to make sure they were in the right range.

So it was those kinds of protocol, if you will, for checking blood sugar periodically, either bringing down appropriately or bringing it up if it was below 100. And we picked 100 to be a safety range realizing that you don't get symptoms or impaired function until you get down below 60 so we thought we had a pretty safe cushion in there for operating range and still was in a reasonable range for somebody with diabetes. We do not want people walking around in poor control of their diabetes so this was not an unreasonable range. So this was the principles of the protocol that we worked on.

Q. How many endocrinologists worked for your committee?

A. I think we had about half a dozen.
Q. And that was the entire composition of the committee?
A. Yes.
Q. And was the recommendations made unanimous?
A. Yes. I drafted them, sent them around to the committee members for comment. There were comments collected, I incorporated the comments, then sent -- made a report. And it was basically

just exactly that. It was a report to the FAA. And then they actually may the decision as to what to do next.
Q. Did they accept your recommendations?
A. Basically they accepted our recommendations. I think in the first version of what they did, they actually proposed these recommendations for all the pilots, class one, class two, class three, and we had made our recommendations specifically for class-three airman or private pilot's license. So then what happened after that with public comment and where they ended up, I think I'd have to go back to the record and

look, but I have not really tracked it.
Q. Have you read the policy statements that the FAA issued with respect to this matter?
A. At what time, what date would that be?
Q. Let me pull a copy out.
A. I lost track.
(Exhibit No. 3 marked for identification).
BY MR. MORENO:
Q. Glance at deposition Exhibit Number 3 if you would.

A. What would you like me to look at?
Q. Well, on the first page about a little further down from where you were reading it says Action: Policy Statement. Do you agree that that means that this is a policy statement of the Federal Aviation Administration; is that a fair statement?
A. Well, it sounds like it. It says it's a summary. It says --
Q. Well, summary is a summary of the policy.
A. "This document announces the new policy of

the Federal Aviation Administration (FAA) regarding individuals with insulin treated diabetes mellitus (ITDM) who apply for airman medical certification. It also addresses comments received concerning this policy as requested in a December 1994 federal register notice. The new policy will permit special issuance of third-class airman medical certificates to certain ITDM individuals who meet selection criteria and who successfully comply with an FAA approved monitoring protocol." So this is now I a document that summarizes what finally happened after all of this work that we

were doing and it actually looks like its affective date is December 23, 1996.

Q. Thank you, Doctor. If you didn't mind glancing through it, just through the document just to be certain that it appears to be what you just suggested it is.

A. Okay. It says the FAA published a notice in the Federal Register in late 1994 of its intent to consider a policy change and opened docket

number 26493 and invited comment to it on a medical evaluation and monitoring protocol for possible use as the basis of the policy change.

Q. That appears to be the background --

A. Yes.

Q. -- of what occurred?

A. Right. And response to comments received from the 1994 notice and to comments from a 1991 petition of the American Diabetes Association. That is how this whole thing got Association.

Q. And it was the American Diabetes Association petition that initiated the consideration by the FAA?

A. Exactly.

Q. Okay.

A. Which is true. Then it defines first-class medical certificate is required and in third-class it defines that a third-class is a private class, and that is what this applies to.

Q. Now, there is a distinction between the Federal Aviation Administrator and the Federal Air Surgeon, is there not?

A. Well, the Federal Air Surgeon I guess is the medical person responsible.
Q. Is --
A. They work closely together.
Q. And the Federal Air Surgeon is the person that you worked together with?
A. I think we were pulled together by the FAA, but I think the report was addressed to Federal Air Surgeon if I remember correctly. I would have to going back to check.
Q. But it was the FAA, the larger administration that showed you around?
A. Yes, and educated us. We actually had - we learned what pilots do from, but we did interact with the officers of the Federal Air Surgeon.
Q. Yes.
A. I had lost track of this and hadn't seen it

and to see if it comes up close to what I told you and what my recollection of what we recommended. Here we go, "In order to provide an adequate basis for an individual medical determination, the person with ITDM," that

term --

Q. What page are you reading from, Doctor?

A. Page 8. The term -- I should explain the term ITDM. Insulin treated diabetes mellitus is distinguished from type one or somebody with type two who requires insulin because people with type two diabetes may also require insulin. So this really covered both type one diabetes and type two diabetic patients who were on insulin.

Q. The concern was dependance on insulin?

A. That's right. The focus was taking insulin. Not whether you were a type one or type two diabetic but did you require insulin. So that was the focus of this. If I can just go ahead.

Q. Sure. Go ahead, Doctor.

A. They wanted copies of all medical records, copies of reports of any accidents, reports of a complete medical examination by an endocrinologist or other diabetes specialist

physician. It was acceptable to the Federal Air Surgeon, and that was an important point that this couldn't be their family doctor. This had

to be somebody who specialized in diabetes that they had to go see.

Two measurements of glycated hemoglobin or hemoglobin A1C with the first one at least 90 days prior, and this was to show stability. You know, you want two different values so the person couldn't be going from good to bad, bad to good. The general idea is you want people who are stable. That was the purpose of that.

A detailed report of their insulin doses including types and what their diet was.

Appropriate examination and testing to detect neuropathy, circulatory insufficiency complications.

They wanted confirmation by an ophthalmologist the absence of clinically significant eye disease. That meant that they had to have a -- which is one of the standards of care. You have to have an annual complete dilated eye exam by an ophthalmologist and it gives more details about that. The fact that

having what we call background retinophathy,

microaneurysms, exudates or other findings of background retinopathy by themselves are not sufficient grounds for disqualification. It had to be something that would be affecting their vision. Background retinopathy does not affect their vision.

Q. Yes, sir.

A. Verification by a specialist that the individual has been educated in diabetes and its control and been thoroughly informed and understands monitoring and management, that is what I mentioned before. They should be receiving appropriate insulin treatment for at least six months prior to submitting it. This is again to make sure that people were stable, they had adequate time to control their diabetes, had not just been started on insulin because it takes a period of time for a person to make the necessary adjustments to learn all they have to learn so we thought that they had to have been on insulin for at least six months. So those were kind of the things to pass the physical exam, if you will. There must be -- the monitoring

protocol must be in here.

Q. I believe if you look at Page 11 where it says Guidelines for Individuals with ITDS Who Have Been Granted Special Issuance of Airman Medical Certificates.

A. Right. This we all -- again, this is my preference for using the term guidelines rather than protocol. I mean, it sounds like what I wrote. It's coming back to me. Medical evaluation by a specialist every three months, glycated hemoglobin at that time and evaluation of their continued ability and willingness to monitor and manage properly their diabetes. You know, that is the motivation part of it. They had to carry and use a digital whole blood glucose measuring device with a memory. That's I think an important fact because you can't fake it. These things have a memory, you can't change what's in there. And so when you bring it into the doctor's office, you can download it and get the past record and make sure that there aren't wide fluctuations showing up in there that the person didn't tell you about. Provide the FAA on an annual basis written confirmation by a

specialist that the diabetes remains under control without significant complications and that they demonstrated reasonable accuracy and recording of their blood glucose measurements with the above device, which means you can download it and review the record. You have to have an annual eye exam. They have to report any episode of hypoglycemia associated with cognitive impairment, whether or not it's related in an accident or adverse event. So kind of any episode of hypoglycemia that would be severe enough to impair your mental function, judgment.

Q. And that is what the concern is about, to be certain that you maintain cognitive ability?

A. Yes. This would basically be reviewed and this is all referring to these periodic checkups. And, you know, you don't want somebody who -- I'm trying to recall now. That maybe they had to be free of severe hypoglycemic reactions for a certain period of time, you know, when they were first given the waiver and then there had to be some kind of ongoing monitoring.

Q. I think this says in there if they experience a hypoglycemic episode that they have

to show good performance for a one-year period. Do you recall that?

A. It could be. This gets into the definition of what severe hypoglycemia means. Does it mean where an individual's ability to function properly mentally is impaired, and if they have this kind of a reaction in their history -- and many people don't. Most people if they are well controlled will never have a significant severe hypoglycemic reaction. And we grade hypoglycemic reactions according to a scale that was really developed with the Diabetes Control Complications Trial. So a mild reaction might be feeling a little hungry or just getting a little -- you know, just many people will pick up the fact maybe they feel a little bit hungry, they get a little queasy in their stomach, their heart may go a little faster or something like that and people recognize that and then they take something to eat and it's gone in a couple minutes, but they never get any impairment of their mental function. That would be a mild

reaction. A more severe reaction would be one in which somebody might not have normal mental

function and then a very severe reaction would be one where you are really out of it and you need help from a third person so we can grade it.

Q. Yes.

A. And this refers to cognitive impairment which means some impairment your mental function. That would have to be reported and reviewed and we thought that we -- people have to be free of that for a period.

Q. Right. It's worrisome even though it doesn't progress to severe is what I'm understanding you say?

A. Yes. You see, that is a safety net that you have to put in any regulation like this whereas most people who are managing themselves would never have that. I think our feeling is that again, you have to judge a person individually to find out what his track record is in this area.

Q. I notice --

A. Here is the glucose management.

Q. This is what you were talking about earlier about activity prior to and during flight and prior to landing.
A. Yes. We set 100 to 300. I didn't remember

it correctly.
Q. You don't want that sugar to get too high?
A. Right. I think it was 400 in the truck drivers as I recall but it was 300 in the pilots. Don't ask me why. I think to the 100, we were most concerned about the lower levels which is the 100. Establish and document a blood glucose concentration equal to or greater than 100 milligrams per deciliter but not greater than 300 milligrams within one half hour prior to takeoff.
Q. You are reading Page 14?
A. Yes. "During flight, the individual with ITDM shall monitor his or her blood glucose concentrations at hourly intervals and within one half hour prior to landing." That was to make sure that it was in a safe range before landing. If a blood glucose concentration range of 100 to 300 is not maintained, the following action shall

be taken, then tell them what to do prior to flight to get it up to 100 and it tells them to what to do during flight and then basically it says if it's below 100 it gives you directions on what to seat and recheck and if it's greater than 100 and you can't got it down, you should land as

soon as practical at the nearest suitable airport.

Q. Okay.

A. So this is in essence what our committee recommended. I have not looked at it for several years so I didn't remember all the details.

Q. I think the rest of the document covers the rationale for the policy statement, a discussion of the comments and some other matters that the FAA -- I would like to ask you some questions about it to the extent that you can answer them. The whole purpose of considering the matter of the issuing these special issuance medical certificates was to alter an existent policy. What is your understanding of the existing policy prior to the FAA action?

A. That if anyone was taking insulin, they were automatically disqualified from obtaining any kind of a pilot's license.

Q. And after the announcement of this policy, it's still the policy of the FAA for second-class airmen and first-class airmen who have flying permission or who would otherwise be able to fly cannot fly because they cannot get a medical

certification --

A. I believe that's correct.

Q. -- if they have insulin treated diabetes mellitus?

A. Right.

Q. Now, you obviously had a chance to learn a little bit about what pilots do. Why is it that they're divided into three different classes pilots?

A. Well, my recollection -- again, I have not looked at this for a long time, but there is -- I believe class-one is a commercial pilot who flies passengers in my recollection; and my recollection is class-two might be a commercial

pilot who doesn't fly passengers but flies cargo or other things like that the UPS pilots and things like that; and class-three airman is a private pilot who just flies himself or can take passengers but not paying passengers. So that is my recollection of the three grades of pilots and what they do.

Q. You agree that piloting, like many other functions in our society, because they have to be licensed, piloting is a privileged duty; not

everybody is allowed to be a pilot?

A. Well, it a privileged in the sense that you have to meet certain requirements to be able to do that just like you have to drive a car I guess would be another example.

Q. Right. You have to have a license or a certificate from a governing authority of some kind?

A. Yes.

Q. And pilots are divided into these three classes, you would agree, on the basis of job responsibility and risks assumed job? I mean,

job responsibility in the sense of what kind of service, like you've suggested, perhaps maybe it's a plane side of the type of plan that is a factor, is it not?

A. Well, I think that the -- my thinking about this would be that a private pilot is generally flying a smaller airplane and it may be less complicated. I don't know. But I think that the real issue is the principal risk they are taking is to themselves or to passengers or maybe a small risk for people on the ground if they crash whereas a commercial pilot who is flying a

passenger carrying jet obviously has people in the plane that are depending on him so there is a kind of this risk issue.

Q. It's fair to say that commercial pilots undertake the higher risk than --

A. Yes. I can tell you the other side of the risk or judgment that a commercial pilot always has a co-pilot and a lot of people thought the risk would be less. That was actually debated. I can recall the debate about it. The commercial

pilot is not functioning by himself whereas as a private pilot is functioning often by himself. And so the question of risk really you could argue both ways.

Q. But the risk arises more from the responsibility assumed for other people --

A. Exactly.

Q. -- than anything else?

A. I think that was the overriding concern, that it's a risk benefit ratio, if you will, or risk and I think that this is always something you have to weigh. The diabetes in this treatment is one example, but there are many other things that can incapacitate a person who

is carrying out a very responsible job. I mean, I can be driving my car down the highway and have a heart attack and lose control of my car and kill myself and pedestrians.

Q. You agree you cannot induce a heart attack though, can you, like you could a --

A. Well, there is a risk out there for sudden things happening to people.

Q. I see what you're saying, but it's a lot easier to induce a severe hypoglycemic episode than to than induce a heart attack, is it not?
A. I don't know. I don't know if it is. I think again it gets back to an individual situation. If a person is well trained, well educated, motivated to take care of themselves, they can do a very good job at it. In fact, they are not likely to have something suddenly happen that is out of their control whereas an individual who is driving a car doesn't and realize that his chest pains that he had the night before last might be a sign of a heart attack can have a heart attack and be catastrophic. I don't think you can generalize about that. I think somebody who is really well

educated, knows what they are doing, they are alert to things that can happen and they can appropriate steps to avoid it.
Q. So long as circumstances are within his control?
A. As long as they are within his control,

right, but somebody who has a heart attack is, quote, catastrophic or sudden illness but there are warning signs there too that people ignore. That is just one example. We can think of other situations. Don't get me talking about alcohol.

Q. So very clearly, the FAA was concerned about the safety and the process, as you've suggested, produced medical and safety standards I think it mentions in the document itself the notion of consistently with aviation safety.

A. Yes.

Q. What does that mean to you?

A. Well, I think that safety is always an issue. I think that is what we're all concerned with, making the individuals healthy and safety when it comes to any kind of high risk occupation, safety of your own person and safety of those that are around you or that you're

responsible for has always been an issue.

Q. And a higher risk activity would involve -- well, in the case certainly of flying would involve the matter of speed. You have a plane

that is moving at a high rate of speed, obviously you have the matter of height if you fall out of air, you have the matter of dealing with the environment and you have reduced room for air reduced room, reduced room for loss of capacity and an increased risk of safety to others?

A. As I was flying into Boston two nights ago from Denver, the flight attendant who was saying, you know, thank you for flying with us, we appreciate your business said, you have now -- I wish you a safe trip home. You are not now about to start the most dangerous part of your journey.

Q. That is certainly not a circumstance where you want a very large margin of error allowed, is it?

A. No.

Q. Now, I think the end result of the FAA consideration in the matter was that type one diabetics or let me change that because you have corrected me. In insulin treated diabetic

mellitus individuals are eligible to perform only certain duties of a pilot, namely those of a

third-class airman and again, only if it conforms with a prescribed protocol. I think it also says that the prescribed special protocol, I assume that means the employment protocol for these limited special issuance licenses that was developed by special panel of distinguished endocrinologists which included yourself provides for operational and functional limitations. These pilots can do -- could not do certain things that the second-class and first-class pilots are free to do?

A. Right.

Q. Why is that again?

A. Well, again, I think that this was the concern over balancing, making it possible for somebody with insulin treated diabetes to do something for which they were otherwise fully qualified, namely fly a private but stop short of the level of responsibility, if you will, for flying a passenger plane or commercial plane. And this is always a judgment call, and my sense looking at this historically is that you kind of

take one step at a time if you move forward in these things. My own personal feeling is that an insulin treated diabetic person who was monitoring and following protocols and maintained their blood glucose could do these other levels of activity just as well, but I think that our society and our government and people that make the rules weren't quite ready for it yet.

Q. And thinking behind, moving forward one step at a time I assume is to gain some experience --

A. Of course.

Q. -- with respect to the risk?

A. The proof is in the pudding ultimately.

Q. Who should make the final judgment with respect to the risk factors?

A. Well, I think -- I think it's a process that is the interaction between advice from panels of experts in a field such as the one that I was part of and the people who make the rules and regulations, the legislative or it really is a societal decision, if you will, ultimately.

MR. MORENO: Anybody need a break?

VIDEOGRAPHER: Off the record.

(Break taken).

(Exhibit No. 4 marked for identification).

BY MR. MORENO:

Q. Doctor, you had mentioned earlier the air-traffic controller program, and this deposition Exhibit Number 3 discusses a comparison between the two, and I notice one of the things that is mentioned is that solo beauty is prohibited in the case of an air-traffic controller but not a private pilot. And as you mentioned earlier, there is a requirement that they maintain the blood glucose level that is a slightly higher level than you would ordinarily require of a person committed to control. Again, why is it that the requirements are apparently stricter for the air-traffic controller than a private pilot?

A. Yes. Well, I think a couple of factors. I think the work that was done with the air-traffic controllers was actually earlier than the work done with the private pilots' licenses. I think that it was considered to be very sensitive because these individuals had been working. Many of them had been working and were removed from

active duty summarily, essentially without looking at individual qualifications or individual performance, and if fact, some of the individuals had been performing very well as air-traffic controllers for a long time. So there was a situation where it was really trying to come up with a protocol that would allow reinstatement of individuals. So this was kind of a reinstatement of something they'd been doing before. So that had a slightly different flavor to it.

I think the other issue was that when air-traffic controllers are sitting there, they are -- apparently there is no downtime. When they are on duty, they have to be continually alert, and they are in a situation where they are being generally supervised. So I think these were probably all things that were in the discussion as I remember and these are kind of issues that came up at that time.

Q. What about the fact that they're responsible not for one commercial plane but for many loaded with passengers?

24 A. Exactly. So all of these things entered

1 into -- let's just say that we're going to set up
2 rules and regulations that will just virtually
3 eliminate any risk -- I mean, the FAA said, we
4 cannot tolerate any risk in this job and the
5 issue came up, well, what if one of your
6 air-traffic controllers has a heart attack or has
7 something else happen to him and you point out
8 that you can never in any situation totally
9 eliminate risk.
10 Q. So you do the next best next?
11 A. Right. So there are long discussions about
12 that. Well, what do you do to minimize the risk
13 then. We were I think in our recommendations
14 were being ultra conservative. We wanted to make
15 it possible for these people to get back to work.
16 And again, I think you brought up the proof is in
17 the pudding, you want to collect data, get some
18 experience, find out how it works, you can all
19 modify the rules later on and so forth. So I
20 think that probably explains the difference that
21 you're pointing out.

Q. I notice on the restrictions on the third-class airman, a person who receives that certificate cannot be required to be a -- let me

restate that. He cannot be a required crew member outside of the United States. I found that curious. Why was that?

A. I have no idea. That didn't cover my report.

Q. I guess in other words, if you sneak across the border, you can't be a required crew member. It seems to me required must mean you have to have it to get the plane up or down.

A. That's news to me. I don't know what that means. It seems to me that that might be a carry-over from having people on commercial flights or something like that, but I don't have a clue.

Q. As you mentioned earlier, the FAA invited comments on whether insulin treated diabetic mellitus individuals should be restricted by class of medical certificates, by class of airman certificates, by operation limits. Now I want to

look at some of those. I know the ADA was interested in making the licenses available to all three classes; is that not correct?
A. I don't know what the official ADA position was.

Q. I don't either. Okay. Are you a member of the American Association of Clinical Endocrinologists?
A. Yes.
Q. Are you familiar with that organization?
A. Yes. AACE.
Q. And did they participate in your part of the consideration of this issue?
A. Not in my part of it. They may have had some opinion about it, but they had no formal involvement that I'm aware of in the selection of the panel. I suppose it's conceivable they might have submitted names for consideration or something but I'm not aware of it.
Q. Okay. Look at deposition Exhibit Number 3 on the bottom of Page 26. I think there is reference to their comments or their

participation.
A. Yes. They may have commented. They probably commented.
Q. It says, In opposition to the policy, the American Association of Clinical Endocrinologists (AACE), do you want to read that?
A. Okay. "In Opposition to the policy was the

American Association of Clinical Endocrinologists (AACE). AACE opposed any policy change which would permit ITDM individuals to be eligible for medical certification. It stated the associated risks of this disease cannot be eliminated and that granting medical certification would pose unnecessary risk to both the patient and the general populace. AACE contended that the physiological effects of flight and the constraints of operating and aircraft decrease the likelihood of proper monitoring and management of blood glucose levels while in flight and increases the risk of impairment or incapacitation of ITDM individuals."
Q. Okay. Well, so there is some disagreement

even among endocrinologists as to the appropriateness?
A. Well, I --
Q. Giving them licenses?
A. I don't know who was involved in that opposition, but this is obviously controversial of course.
Q. A little bit further down I think the -- is it the Endocrine Society?

A. I am I member of the Endocrine Society too.
Q. Did I pronounce that correctly?
A. Yes. I think it was the next paragraph. I think they also they also came out against this as well.
Q. They, "Also opposed any change of FAA policy regarding ITDM individuals. The society stated that if a special issuance of a medical certificate is to be granted, an ITDM individual who has had even one severe hypoglycemic within the last three years should not be eligible for issuance of a medical certificate." It also says, "It further contends -- this is what I

wanted to ask you about. "It further contended that food ingestion should never be permitted in lieu of hourly in flight glucose testing and that an ITDM individual should have another qualified pilot in the cockpit at all times and that an ITDM individual should not be allowed to pilot commercial aircraft." They point, "The society pointed to the results of a recent study on the treatment of individuals with ITDM which shows that proper treatment of patients with ITDM requires tighter control of blood glucose levels

and leads to an unavoidably higher risk of a hypoglycemic reaction. According to the society, tight control of the blood glucose level of an ITDM individual produces significantly better long term outcome through the reduction of the occurrence of nephropathy, retinopathy, and neuropathy. Therefore, the society stated, appropriate treatment of ITDM individuals would unavoidably lead to a higher risk of hypoglycemic reaction, which should preclude these patients from obtaining special issuance of a medical

certificate." It's the last part.
A. Let me give you my opinion. This was in '95, '96. The Diabetes Control and Complications Trial results were published in '93. This was a landmark study that really showed beyond any question of a doubt that average blood sugar as close to normal markedly reduces the development of these long term complications so retinopathy, neuropathy, nephropathy, what is called microvascular complications of diabetes. And it's true that on average in that study that the attempts to get the blood glucose to as close to normal as possible so people were taking multiple

shots a day, they were told keep trying, keep trying, keep trying was associated with an increased risk of hypoglycemic events in the study as a whole. But what was not recognized at that time was that when you analyze that the increased risk of hypoglycemia was not across the board. It was in a subset of individuals who tended to get hypoglycemic reactions, but there are many people who achieved the targets who had

no hypoglycemic reaction. So again, it gets back to the individual situation. I think what the Endocrine Society was concerned about is we don't want people to go around in letting their blood sugars run too high and be at increased risk of long term complications just so they can fly an airplane. I think it was this balancing act.

Again, I don't know who specifically at the -- Endocrine Society, I don't recall who actually made these comments, but I'm -- from the comments, I'm sure it was what the concern was, that if you push and push and push, the DCCT results did show increased risk of hypoglycemic reactions in the group with intensive control, and they didn't want people backing off and

getting more complications.

I think as we learn more about this -- we've learned a lot from the diabetes control and complications trials. We've learned that you really adjust the degree of control based on an individual basis. Some individuals can get their hemoglobin A1C down to normal and never have a

hypoglycemic reaction. Other people can be relatively poorly controlled and they have lots of hypoglycemic reactions. So this gets back to the whole issue again of individual -- you have to look at each individual separately.

Q. Well, one of the commentators or comments I think is the terminology says implementation of the proposed guidelines relies too heavily on the applicant's objectivity and honestly in assessing his or her medical condition. That was the objection to the --

A. The honor system.

Q. Yes. The employer or the public in all cases has to assume the risk of the honor system to the extent that is it's not fully --

A. I'll give you my opinion about that too. I think this is part of your working with an

individual with diabetes. You know pretty much when you're working with somebody, especially when you can download their meter and see if they are being honest with you or not or just if what they say their control is or if it matches their

hemoglobin A1C or it doesn't, you have a pretty good working knowledge of whether somebody is managing their diabetes well or not. I think that is part of the evaluation that I would certainly do in considering somebody whether they're really medically qualified to perform at high risk occupation. Again, you can't make a rule that fits everybody.

Q. The report also says and I'm not -- it's in there I know. It says the ADA requested the creation of an FAA appointed medical task force to develop a medical protocol to permit case by case review of applicants for airman medical certificates of any class. Do you recall that request being made?

A. It was not -- this was all stuff that came out in probably either comments or around this time. I don't recall exactly when that was made. It doesn't surprise me that the ADA really wanted

to set up a medical task force to look at this because it's clearly -- it's clearly the message that somebody who has diabetes, takes insulin,

responsible, well controlled, well educated can do anything for which they're otherwise qualified.

Q. To your knowledge, was a medical task force of that type ever created?

A. Well, no. I presume it doesn't refer to the committee that I served on.

Q. That's right. This is for all classes of airmen.

A. I don't know whether that one was ever formed or not.

Q. Did the ADA have such a committee?

A. Not that I'm aware of.

Q. Certainly it's feasible for the ADA to create such a committee?

A. They could. I actually don't know whether one was created or not subsequent to that. I have not heard that one was but I don't know. I'm sure we could find out.

Q. One of the things I discussed briefly with Dr. DeFranco was the idea of a type one diabetic

participating in combat. The Vietnam War comes

to mind. Is that something that you think a person who is highly motivated could participate in or would he be facing unacceptable risks?

A. Well, I don't know. I don't know what the military rules are specifically regarding insulin treated diabetes and combat duty. I know that there are many people who have gone through wars with their diabetes and survived and done well, but I don't know what the military policies are. I know one person who made their own insulin all through World War II when they were in Shanghai when the Japanese overran the city, and she was an insulin treated diabetic. Her husband was an engineer there and the insulin got all used up. There was no insulin available. He somehow got access to a book in the library of how you isolate insulin, went to the local abattoir, got pancreases, made a crude extract of insulin and not only treated his wife throughout the entire Japanese occupation but treated like 100 children with type one diabetes through two or three years of Japanese occupation in Shanghai. This was a remarkable woman who described the insulin she

took as kind of looking of looked Coca-Cola. It was not very pure insulin. So people get pretty creative in this business.

Q. I had a discussion with Dr. DeFranco about the absence of tests for predicting whether a person experiencing a hypoglycemic occurrence, and I came away with the feeling that the best available approach for prediction right now whether a person will develop a hypoglycemic reaction is really what you do clinically by accumulating information about the patient, clinically treating him, clinically reviewing his blood glucose values and clinically attempting to bring about the best possible control while avoiding hypoglycemia by making adjustments to the insulin prescribed and how it's administered. Do you agree with that?

A. Yes, fundamentally. The best predictor is probably experience, the track record of an individual. I mean, if they have been able to go for a year or two or three years or five years or whatever without hypoglycemic reactions, then I think the likelihood of them having one in the next week or two is pretty low. If somebody has

a history of having a lot of hypoglycemic reactions, chances are better. So I think just looking at track records is really an important thing to do and the way to avoid it is what we have discussed. It really is training and self-management and being smart about what you are doing.

Q. A test that would predict whether you would or would not have a hypoglycemic episode is kind of like prevention, it's desirable but it's not there yet?

A. Can you predict if you're going have to something else happen to you? You can never predict the future 100 percent, but I think that you have a pretty good idea what is happening. And a person who monitors his blood glucose, who knows what a unit of insulin or two units of insulin will do to his blood glucose, knows what a certain amount of food or type of food does to his glucose, knows what exercise does to his glucose, he has a good knowledge base.

Q. There are tests in medicine though that allow to you do some predictions?

A. Well, blood glucose is continually

fluctuation in a pretty narrow range. We do know if you have too much insulin on board, the blood sugar will drop. You know the physiology.

Q. I'm not referring to blood glucose. Just generally in medicine you physicians rely on certain tests to predict certain outcomes, do they not? I mean, medicine is not free -- free is not the right word. But medicine doesn't operate without such tests?

A. Right. Trying to predict what is going to happen with a patient with a certain disease, is that what you're referring to?

Q. Yes.

A. Depends on the knowledge that you have about that person and the disease.

Q. Right. But there are some tests that actually assist the physician in predicting outcomes?

A. Give me an example.

Q. Well, I would rather you give me one.

A. I'm trying to think of one I mean that would fit with what you are driving at because I'm not

really sure what you are driving at. I'm having a hard a time. If someone has a cancer, can you

predict how long they are going to live? Well, sure, you can give averages based on statistics from experience with a lot of people. But there are plenty of people that as an individual, it's very difficult to predict what is going to happen. I would say that you're trying to use your knowledge, your judgment, your experience to make your best guess about what is going to happen, but I don't know anybody that has a crystal ball that's going to tell you what's going to happen.

Q. I don't think anybody is holding you to a crystal ball standard. Well, back to the frustration of the researchers, you would agree that the goal of the technology is to mimic in a sense, to develop a device or a method or means that automatically that things like automatically detects, automatically detects the blood glucose level, automatically signal the appropriate source of the need to make insulin, automatically

make insulin appropriate to respond to the blood glucose levels detected or measured automatically, infuse the insulin and automatically stop making the insulin as the

blood glucose level is detected to be started to fall. I mean, isn't that the missing piece?
A. Well, first of all, I wouldn't say it's frustration. I would rather use the term challenge. I don't feel frustrated. I'm very excited actually about the progress we're making and the things we are doing and I think that watching -- I've been working in this field for over 30 years. You have to kind of pinch yourself once in a while to remember what it was like 10 years ago or 20 years ago or 30 years ago. We've made incredible strides. I feel really positive about -- I think the future for people with diabetes in year 2000 is totally different than it was in 10 years ago or 15 years ago and particularly in our ability to achieve good control and avoid these long term complications. You know, ten years ago if I took

you to the eye institute on the first floor here, you would see a lot of people with seeing eye dogs. I haven't seen a seeing eye dog in this building in a year. We can now with annual exams by somebody who knows what they're looking at, with early detection, laser therapy prevent 95

percent of the visual loss.

We know we have made huge strides in reducing the kidney disease. It's true that diabetic renal disease is still the most common reason for a person to go into a kidney dialysis program or a kidney transplant program, but those numbers are falling dramatically. So I actually when I look over the years, we've made tremendous strides. Now, sure the wholly grail is to be able to prevent or cure the disease altogether, and we will all be extremely happy. We are not there yet.

Q. When you do that, you will restore or bring about automatic regulations?

A. What we are trying to do is to come as close to restoring the normal physiology as we can.

Excuse me.

(Break taken).

BY MR. MORENO:

Q. I just would like to read you some propositions here and see if you agree with them. Well controlled conditions exist when the scheduling of meals and diet and the amount of physical exertion are regular and preplanned and

the amounts and timing of insulin injections can be predetermined.

A. I disagree with that completely. I think that that is maybe the thinking of 20 years ago, and now the thinking is to train people in self-management to make their life as flexible and variable and normal as they can so they can do whatever they their jobs require or they want to do in their recreation. I think that we now have the tools to free people from this sort of rigid type regulated life to give them true flexibility, and we've made tremendous strides in that area. So what I do when I'm working with my patients is train them to do the things we have

been talking about to allow them the flexibility. I work with a lot of college kids who pull all-nighters, who decide at midnight to go out for a pizza, and people with diabetes have to be able to do that and they can. So flexibility is the word, not rigidity.

Q. How about this one, utilized in intensive therapy, there would be a substantial risk of a severe hypoglycemic occurrence if a subject type one diabetic took an injection of insulin

immediately before eating a meal and if the meal and or some form of carbohydrate or glucose became unavailable or was missed because of job or other constraints?

A. Well, we have a way around that one too, and I think that this was talked about this before too. The rapidly acting insulin that we use, Humalog, which you can carry with you at all times in a pen so you can take it. You don't take it until the food is in front of you. I actually have some people who actually take it right in the middle of the meal so it avoids that

-- you can avoid that situation. You don't take your insulin until you are ready to take your food or if you're in a situation where the food may be snatched away from you, you can eat first, then take your insulin.

Q. Right. But if you have taken your insulin in anticipation of being able to ingest the food, then an emergency occurs, you have a problem?

A. Suppose I gave you an injection of insulin, you don't have diabetes, okay, and just gave you an injection of insulin and said, I'm not going to give you any food to cover it, you would

develop hypoglycemia too.

Q. That's right. If I were a police officer and I had to go save somebody's life and it was either my life or his life, I would have a problem with that.

A. No, I don't think so. First of all, you can always do the situation where have got the food in one hand and you take your insulin to cover it. If you have food with you, so suppose you started your meal and you've taken your insulin

and now the alarm goes off and you have to get up and run, you can always have a candy bar with you, you can have something to drink. I don't really see that as a problem.

Q. But you would have to pay some attention to that on your way out the door, would you not?

A. Of course would you. I don't I have many of my patients that wouldn't pay attention to that I guess is what I'm trying to say.

MR. MORENO: Doctor, you are very kind to answer my questions. I will turn you over to Mr. Griffin.

EXAMINATION BY MR. GRIFFIN:

Q. Give us your full name, Doctor.

A. Edward Shore Horton.

Q. And what do you do for a living today?

A. Well, I'm a professor of medicine at Harvard Medical School and I'm vice president and director of clinical research here at the Joslin Diabetes Center. What that translate into is have the kind of traditional academic career. I see patients and manage people with diabetes and

related conditions, I carry out research and mostly clinical research and do I teaching.

Q. All right. Is Exhibit Number 4 a copy of what we non-doctors call a resume but in medicine is CV or curriculum vitae of yours?

A. Yes.

Q. And all those dozens of articles reflect under the research that you have done in the area of diabetes?

A. Yes, that's correct.

Q. How many years of your career has been devoted to the both treating patients and researching diabetes?

A. Well, I completed by specialty training in endocrinology and diabetes in 1967 and so I was working in the diabetes field from 1964 to 1967

specifically, and then I've been working full time in endocrinology and metabolism, internal medicine since 1967.

Q. All right. I want to talk to you about four or five developments that you talked about with Mr. Moreno. I'm just going to hand you -- it's

not an exhibit, but let me hand you what I believe to be an insulin pen.
A. Right.
Q. Now, does that pen reflect two of the most recent technological advances in the treatment of type one or I should say insulin treated diabetes?
A. Well, I think the thing that is the newest is the type of insulin that's in this pen, humalog insulin, which was developed by Eli Lilly, also called lyspro insulin which is a modification of insulin that makes it absorb very rapidly and a shorter duration of action than regular insulin. So this is the type of insulin that we currently have many of our patients using just prior to meals or just at the time they are ready to eat a meal to provide the insulin they need for covering that meal. It's also the type

of insulin that most of our patients are using in an insulin pump now.
Q. Before 1996, was there even such a thing as insulin that would be absorbed rapidly within a

matter of an hour or two and its left-over effects dissipating shortly thereafter? Did we have such and insulin?

A. No. This is the first insulin that has that characteristic. The regular insulin, which has been available for a much longer period of time, is more slowly absorbed and lasts somewhat longer and this is the first of these so-called modified rapidly acting insulins to be available.

Q. I want to show you what I carry around with me, but maybe you could show it to the camera and ask if that depicts actually the method of action or the length of time that insulin actually operates within the body?

A. Yes. This is a graph which does kind of show the absorption and time course of three different types of insulin. The one on the top is this Humalog or lispro which is absorbed very rapidly and is then is gone in just a few hours. The middle one I believe is regular insulin which

shows a slightly slowly absorption and longer duration of action. And the bottom one is NPH

which is what we call an intermediate insulin which is more slowly absorbed and lasts usually 14 to 16, 18 hours, not quite 24 hours and we use that for what we call basal insulin treatment. These are three insulins. There are other ones that are available as well.

Q. Sure. What was -- when the history shows that this significant development of the development of the Humalog or the lispro insulin, what does this mean when it says that it's the first human analog insulin?

A. What it means is they have taken two amino acids in the molecule and changed them. Actually, they've changed the lysine and prolin and that is why it's called lyspro insulin. What this shift in the two amino acids in the insulin molecule have done is it's changed the aggregation characteristics of the molecule so that instead of forming hexamers, it does not form hexers. It really forms dimers and they are rapidly disassociated. So this is how they have achieved the very rapid absorption

characteristics of the insulin. So when they say it's a modified human insulin, it's in all other regards, it has the same biological activities as human insulin. It just by changing the position, they change the shape of the molecule so that it's absorbed more rapidly.

Q. Now, the actual pen itself you are looking at, the delivery system, is that something that became available for the general public around 1998, 1999?

A. In the US.

Q. Yes.

A. Yes, that is right. In the US we've tended to use needles and syringes as our standard way of giving insulin. Pumps have been around for a while. The pen system, the Nobo Nordice Company had a pen for many years. Pens have been available in Europe and used quite extensively in Europe, but they were really introduced by Eli Lilly Company in the US just within the last couple of years.

Q. Did they --

A. -- have also had pens available for a while, but they are really catching on and because of

their convenience.
Q. Did they avoid the necessity of the patient actually getting the vile of insulin out of the refrigerator, then carefully drawing it up in the syringe and can you avoid that by using the dial on the pen for a precise dose?
A. Yes. The way that this works is that you put a needle on it, it's like little syringe and you just dial in your dose and then you can just inject it. So you're carrying it around with you all the time. You don't have to take the time to draw it up. It's convenient, it's quick, it's easy.
Q. Now, let me ask you this, ten years ago, were you able to have patients to have monitors that would maintain memories and uploadable computer data to download to the doctors as a regular treating mechanism?
A. Well, probably ten years ago is when the first ones starting coming. We went through the whole evolution of doing -- of putting a drop of blood on a strip and just being able to then rinse it off and hold it up and match the color with a scale and then they developed meters,

reflective meters which would actually read it, then they improved the technology so that they developed memories so you could download them. This has been an evolution of meters. Meters have gotten even smaller, more convenient to use, less mess, faster and now there are just a very convenient thing to use.

Q. Let me ask you if this is an example of the kinds of meters that are available at any Walgreen's Drug Store today?

A. Yes. Well, this is an Exact Tech which was made by Medisense which was located here in Boston so you picked a Boston meter. Yes, this is an example. It's about the size of a credit card, fits in your pocket and you can check your blood sugar in just a matter of seconds with this any time you want.

Q. Have all of these devices that we've talked about and what you've discussed with Mr. Moreno given the individual who has insulin treated diabetes the methods that allow them to control their blood sugar?

A. Well, these are all tools basically people

1 is to get information, to find out what your
2 blood sugar is at that particular point in time,
3 use that information and make a judgment about
4 eating some food or exercising or taking an
5 insulin dose.
6 This pen system is an example of a
7 convenient way to take a rapidly acting insulin
8 and so people have many more tools now to manage
9 their own diabetes.
10 Of course key to this is training program,
11 training in self-management, learning the
12 physiology that they need to know to make these
13 judgements and then the day-to-day experience
14 that you get by actually doing it.
15 Q. Have these changes in medical technology in
16 your opinion resulted in the changing world of
17 commercial truck drivers, pilots, air-traffic
18 controllers and scuba drivers all in the past
19 decade?
20 A. Yes. I think that people now have much more
21 control over their diabetes management and much

more flexibility in their day-to-day life and much more freedom. So that by checking blood sugars, by adjusting insulin and the different

types of insulin by food intake. All of these things people can lead much more flexible lives than they could before we had these tools available, and they can maintain their blood glucose levels in a near normal range or close to normal range while avoiding wide swings blood glucose from either too high or too low.

Q. So if I hear what you're saying by sacrificing, that the patient is sacrificing their time and taking care of themselves and responsibility in blood monitoring and keeping their blood monitoring up to date and also using their judgment about their insulin, they are able it keep their blood sugars in a normal or near normal level?

A. Yes. I mean, it takes a lot of work. It does take a lot of work. You have to -- currently the best way to know what your blood sugar is is to prick your finger and get a drop

of blood which hurts a little bit to do it. And you have to take that, you have to have the knowledge and the training to know what to do with the information. You have to figure out how much insulin to take, what to eat, how to balance

the two. You have to know what exercise is going to do. So you have to be savy and well trained to do this so it does take a lot of work, but many of our patients get very, very good at it, and they do whatever they need to do for either their occupation or their recreation.

Q. Well, let's talk about -- just for a moment why don't I ask you about some hypotheticals of what would happen if somebody put a gun to somebody's head after they'd taken insulin but before they were able to eat their food. Can anyone that who is at risk of being kidnapped before they can eat, are they are able to avoid that merely by giving their fast acting insulin after they've finished eating?

A. Well, they can do that. If they thought that they were in a situation where something

like this might happen, you know, they can certainly take their insulin after they ate. I think if they are -- if you wanted to make an error, you know, you're put in a situation where you can't control things, it's out of your control, you want to have your blood sugar on the high side rather than the low side so what you

would do is either take extra food if you could or withhold insulin or delay insulin or something like that.

Q. So let me ask you this, in your experience in your 30 years of treating patients, have you ever had a patient complain that they were forcibly taken from their meal while they were at the table?

A. No. I think the most common situation I've seen is when somebody goes to a restaurant and they take their insulin -- this is the days before the rapid acting when you had to take regular insulin 30 to 45 minutes before. They've taken their insulin and their food didn't show up.

Q. Right. Sure.
A. That can be a problem, but where somebody has been forcibly -- I mean, they have taken insulin and somebody has prevented them from eating, I have never come across that.
Q. But even if a police officer has -- well, first of all, can a police officer or anyone else who is at risk of being kidnapped or called out to duty after a shot of insulin but before they

eat, can they carry a pack of Life Savers in their pocket and avoid even the potential of hypoglycemia --
A. Well --
Q. -- by covering the insulin with the Life Saver?
A. I tell everybody who is -- to carry food with them, particularly -- let me give you an another example that may be more real life than the one you described -- although what you described is potential -- and that is the athlete who goes out for a long training run or something like that. I always have them carry some sugar

tablets or Life Saves or some sort of rapid source of calories and sugar with them. So I think anybody who is working in a situation where the unexpected is going to happen should have food with them. I think that is part of the protocol.

Q. So in other words, as a sacrifice as small as carrying a pack of Life Savers is enough to satisfy that potential?

A. Generally I would say that is true.

Q. Okay. Now, when a dedicated person who has

followed the physician's advice and maintains a educated prospective with the disease, is that person using their vigilance to regulate their blood sugars?

A. I'm sorry. They're using their --

Q. They are using their vigilance and their dedication to regulate their blood sugars in the absence of a totally functioning pancreas?

A. Yes. They are making decisions. They have to make decisions based on a lot of things we've talked about. Based on what their blood glucose

is, what they are going to eat, what their exercise pattern is going to be so some people say they're thinking for their pancreas.

Q. Sure. In diabetes patients, is there a wide variety in the dedication and their ability to control their blood sugars in the whole pool of millions of diabetics we have in our country?

A. Of course. I mean, there is a lot individuals variation in terms of both training and knowledge and motivation. Sure, of course there is a lot of variety in that situation.

Q. And some patients who are unable to maintain a safe levels of sugar or glucose in their

bloodstream perhaps might not be candidates for some jobs whereas others who are well controlled are suitable?

A. I certainly agree with that. It really depends on the individual. You have to assess each person as they come along as to whether they are trained adequately, motivated adequately, capable of managing their blood glucose adequately for whatever occupation or recreation

for that matter that they're going to do. So there is a lot of individual variation.

Q. Doctor, can you give us your opinion as to whether there is any justification whatsoever for any kind of a blanket exclusion or a one size fits all approach to the employment of diabetics in driving positions or law enforcement positions?

A. Well, in my opinion and I feel very strongly about this, that one really has to really access each individual person on their own merits, that you cannot make a blanket rule to cover the whole group of people with diabetes. That would just be blatantly unfair because there are many people who can manage their blood glucose very

successfully and can do anything they want to do, be a professional athlete, be a scuba diver, be a sky driving, be a marathon runner, do whatever profession they want to do. So there clearly are individuals that are trained, dedicated, capable of doing that, and there are others that I would never recommend that they do those things because

of their lack of knowledge or lack of motivation or just not being able to manage their glucose adequately.

Q. And are you comfortable, Doctor, with capable endocrinologists and diabetologists evaluating patients to help make these kinds of determinations?

A. I think that it takes -- in terms of management, it takes a team approach, but in terms of evaluating somebody to find out how well they are doing in this regard and what their capabilities are, I certainly think you need to have somebody who is trained in endocrinology, metabolism and who works with diabetes as a specialist.

Q. And regardless of the occupation, is the most important consideration the patient's own

responsibility and compliance with a treatment with his or her own treatment plan which keeps their blood sugars in a safe and normal range?

A. Well, I certainly agree that the patient has the major responsibility for managing their

diabetes, and the role of the health care team is really educating people and training them and giving them tools, but the ultimate responsibility is with the individual. They are the ones that are making decisions on a day-to-day basis about how to manage their diabetes.

Q. Let me conclude by asking you this question, if a judge was looking to have someone to address the area of diabetes care and the evolution and the improvements that have been made, say, in the nineties, what kind of qualifications and credentials should the judge be looking for?

A. Well, certainly if you want to put an individual --

MR. MORENO: Excuse me, Doctor. I will let him answer that. I just want the record to reflect that he can't speak for a judge. He is not qualified.

BY MR. GRIFFIN:

Q. What is important in your opinion, Doctor, in looking for a person who has the right kind of

qualifications to talk about the evolution and improvements in diabetes care during the nineties?

A. Well, I think somebody who specializes in the field. I think from clinical care point of view, you certainly want endocrinologists, diabetologists who specializes in that area. I think if you're interested in finding the latest research and things that are going on, you probably want somebody who is in an academic institution who is either involved in research themselves and knows the field of research. So I would -- I think in any situation if you are trying to put together a so-called expert or group of experts to advise in this area, they should be highly trained and active specialists in the field.

Q. When you say highly trained, what do you mean by that?

A. Well, to become an endocrinologist, certified endocrinologist in metabolism in the

adult medicine -- I will talk about adults and

pediatrics if you want, but in adult medicine, the training -- you have to first of all be trained in general internal medicine and you have to take and pass the specialty board from the American Board of Internal Medicine, then you have to take additional training which we call a fellowship in endocrinology and metabolism and that's a minimum of two years of training. And then to become certified as a specialist in endocrinology and metabolism, you have to then take a subspecialty examination in endocrinology and metabolism to become board certified. So it's a two-step process. You have to be internal medicine first which is a three-year training program, then you have to do at least two years of endocrinology metabolism fellowship and there are two different exams, then you are certified as a specialist in that area.

Once you're certified, people can specialize in different areas of endocrinology metabolism, but many people work mostly in diabetes and diabetes related diseases for example. So it's the experience that you gain after your normal

training.
Q. You mention research. What kind of research would we be looking for in addressing diabetes care over the past ten years?
A. Well, I think since we're talking about clinical care, we're talking about the translation from basic research into practical clinical areas. So I think that you would really want to focus on the translation of basic knowledge into clinical care and this would generally fall into clinical -- investigation or clinical research. Now, the foundation of that is also basic research so you may want to really know the fundamental research going on that now allows the technological advances that get translated into care. So you may want to look at the whole spectrum, but I think the most immediate problem is if you're trying to understand the real advances at the care level, you would probably be involved in what we call clinical research.
Q. Okay. Now, in terms of publication and that sort of thing, what kind of articles would you be wanting to look at in terms of determining

whether or not a person is qualified in the area of talking about advances in the medical care of diabetes?

A. I think you would be specifically -- again, getting down to a practical level of care, you'd be interested in new insulins that are being developed, new insulin delivery systems that are being developed, better monitoring systems, the sorts of things that provide the tools for day-to-day management. You would also be interested in advances going into eyelet cell transplantation, pancreas transplantation, other types of things that can help people with diabetes. But what you're still -- eyelet cell transplantation, for example, is still considered experimental so there are things that are in various stages of development coming down the pike. But I think that the newer the developments and new types of insulin, newer and better insulin delivery systems and newer and better glucose monitoring systems are three critical elements that we need to know.

Q. Let me ask you ask you about some articles and tell me if any of these have to do with

diabetes that you can tell. "Variations in Response of CAT Esophageal Muscle to Stimulation with Drugs," does that sound like anything that has to do with diabetes?

A. Say this one again.

Q. "Regional Variations in Response to CAT Esophageal Muscle to Stimulation with Drugs."

A. Well, I would I think that is probably looking at motility of the esophagal muscle and response to different drugs. I don't know whether it's related to problems of autonomic neuropathy, gastrointestinal diabetes or it could be just a basic article looking at drug effects on smooth muscle contraction.

Q. Another title "Effective Various Cell Free Organ Extracts on Hematopoietic Stem Cells."

A. Well, that would be in the general field of hematology. Looking at factors would probably cause a differentiation and growth of -- hematopoietic refers to the blood cells and blood system.

Q. "Isolation and Characterization of Aldose

Reductase from Calf Brain."

A. Well, aldose reductase is an enzyme that

regulates sorbitol metabolism. One of the problems in diabetic neuropathy may be related to accumulation to sorbitol in nerves and so there is a great interest in aldose reductase inhibitors in the treatment of diabetic and prevention of diabetic neuropathy. So that article could have some relationship to new approaches to prevention or treatment of diabetic neuropathy.

Q. And it says here, "The insulin receptor is an age dependent integral component of the human erythrocyte membrane." Is that talking about insulin receptors or cells in type two?

A. Well, they are talking about insulin receptor in the red cell membrane, and red cells are one of the tissues in the body that do not respond to insulin. Glucose moves across the red cell membrane not in response to insulin. So that article would have to do with some residual proteins that look like insulin receptors in the

red cell which is not an insulin responsive tissue. So that it's a very basic research type of article.

Q. And finally moving more recently "The Effect

of Endurance Training on Serum Triiodothyronine Kinetics in Man Physical Conditioning Marked by Enhanced Thyroid Hormone Metabolism."

A. That is an article about thyroid hormone metabolism. Triiodothyronine or T3 for short is one of the two active forms of thyroid hormone. We have T4, which is thyroxin, and T3 are the two active forms, and actually there is a conversion of T4 to T3. And this is an article looking at the effects of physical training on the kinetics of thyroid hormones metabolism. So that's not really specifically to diabetes but to thyroid hormones metabolism.

Q. And last of all, what journals would we be wanting to look at in terms of the leading journals published in the area of diabetes?

A. Well, the two leading US journals are Diabetes and another one called Diabetes Care.

Diabetes focuses more on basic research, although there is clinical research published there. Actually, I'm an associated editor of that journal. Our editorial offices are right here in this building on the third floor right next to my office. I closely work with that journal.

Diabetes Care is also an official publication of the American Diabetes Association and it focuses more on clinical treatments, new drugs, new treatments, so forth, and the editor of that journal is Dr. Charles Clark at Indiana University and in Indianapolis currently. And so those are the two leading US journals.

The major European journal is a called Diabetes Logia, and that's the official journal of European Association Study of Diabetes and then there are a variety of others. But if I had to pick three journals that would have the most up-to-date research and clinical research literature, it would be Diabetes, Diabetes Care and Diabetes Logia.

Q. Are you acquainted with Dr. Ralph DeFranco?

A. Yes, I am.
Q. How long have you known him?
A. Well, at least 25 years.
Q. How did you get to know him?
A. I got to know Dr. DeFranco through -- I first met him when he was at Yale University and I was at the University of Vermont, and we have many common research interests. So I met him

through our common research. I have met him through meetings. And I don't know how much detail you want to go into. I gave him his first ski lesson for which he has never forgiven me. I met him and known him for --
Q. Do you folks attend diabetes conferences around the world in terms of gathering of the brightest minds in diabetes?
A. Yeah. We have seen a lot of each other in a lot of meetings, and we've interacted a great deal.
Q. Do both of you publish extensively?
A. Yes.
Q. Are you acquainted with a physician by the

name I think of Dr. Brian Tulluck?

A. I know Brian Tulluck.

Q. How do you know that gentleman?

A. He is head of the diabetes unit at University of Texas in Houston. I have also met him professionally at diabetes meetings. I have actually had him as a speaker on a program that I chaired so I've met him through professional channels.

MR. GRIFFIN: Thank you very much.

I'll pass the witness at this time.

EXAMINATION BY MR. MORENO:

Q. Doctor, you stated your opinion with respect to justification for blanket exclusion, but you acknowledge again that there is a difference of opinion with respect to whether there ought to be blanket exclusions of individuals with insulin treated diabetes mellitus?

A. Well, at least in the situation of the pilot's license there was that, and I'm sure that there's got to be a difference of opinion in different areas. But I think that what we were

discussing earlier was specifically the comments that were submitted about the proposed rules and regulations for waiver for third-class airmen.

Q. I see.

MR. MORENO: That's all I have.

EXAMINATION BY MR. GRIFFIN:

Q. Doctor, have you -- are you acquainted with any in your -- let me rephrase the question.

In your -- in the last ten years of your dialog with other leaders in the field of diabetes, have you ever heard any of your colleagues take the position that insulin treated

diabetics ought to be excluded as a group from serving in law enforcement positions?

A. I have never heard that.

MR. GRIFFIN: That's all, Doctor. Thank you.

(Whereupon the deposition concluded at 4:50 a.m.).

COMMONWEALTH OF MASSACHUSETTS

COUNTY OF BRISTOL

I, Kim M. Romaine, a Professional Shorthand Reporter and Notary Public and for the Commonwealth of Massachusetts, do hereby certify that the foregoing deposition was taken before me on May 25, 2000.

The said witness was duly sworn before the commencement of his testimony; that the said testimony was taken stenographically by myself and then transcribed. To the best of my knowledge, the within transcript is a true and accurate record of said testimony.

I am not connected by blood or marriage with any of the said parties, nor interested directly or indirectly in the matter on controversy.

In witness whereof, I have hereunto set my hand and Notarial Seal this 30th day of May 2000.

Kim M. Romaine, Notary Public
In and for the Commonwealth of
Massachusetts
My Commission Expires:
July 29, 2005

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