DEA Museum Lecture Series

DEA Forensic Sciences: Then & Now, October 22, 2015.

SEAN FEARNS: Hello, everyone, and welcome. My name is Sean Fearns. Welcome to the DEA Museum lecture series.

SF: Today we're in a pretty unique location. Normally we're at the DEA Museum. Today we're actually at one of DEA's forensic sciences lab at an undisclosed location in Virginia. You may notice that the audio volume is a little bit different in the background. We're actually inside a functioning laboratory that's a little noisier than our normal setting, so bear with us.

SF: Today we're going to talk about a laboratory system and not only how it works, but how it's changed over the last 40 years. To get us started, I want to introduce the director of the exact location where we are today, the DEA Special Testing and Research Lab Jeff Comparin. And just for a little bit of background, Jeff has a Bachelor of Science degree in chemistry from Northern Arizona University. He has come up through the ranks as a DEA forensic chemist. And then, in 2002, he became the director here at the DEA forensic Special Testing and Research Lab.

SF: Director Comparin, thank you for having us today. I'm hoping that perhaps you can tell us a little bit about DEA's forensic laboratory system in general and then maybe a little bit more specifically about the laboratory we're in this afternoon.

JEFF COMPARIN: Certainly. Thank you, Sean. Thanks for the introduction. And welcome to the DEA Special Testing and Research Laboratory. It's our pleasure to have you here and host this event.

JC: With respect to the laboratory system, we have 10 laboratories. There's eight large chemistry laboratories, such as the one you're in today. We have one sub-regional chemistry laboratory and one laboratory dedicated solely to the examination of digital evidence. The labs are staffed with dedicated professional support personnel and analysts.

JC: We analyze drug evidence, obviously, latent print evidence, and, of course, digital evidence. We're accredited. We produce high-quality DEA results in accordance with our standards, but we also meet national and international accreditation guides. So we produce a very high-quality and worthy product.

JC: We're able to testify in courts as a result of our expertise. We also respond to crime scenes, for us, clandestine laboratories. And sometimes, we conduct trace evidence collection operations.

JC: If I can talk a little bit about this laboratory, we're a little bit different than the other DEA labs in the forensic laboratory system. We're dedicated primarily toward intelligence. The primary consumer of our information is DEA's Intelligence Division, other components of the intelligence committee-- community that are involved in counter-drug activities. The Office of National Drug Control Policy is very interested in the results that come out of this laboratory, primarily because we figure out where drugs came from, their origin, or how they were made.

JC: And I'll talk briefly about some of the special programs that we do. Cocaine signature-- cocaine signature is a program dedicated to the in-depth analysis of cocaine samples to figure out where the coca leaf grew that actually produced that seized brick of cocaine hydrochloride. That group just announced some very exciting results and the ability to conduct sub-regional geographic determinations for coca leaf.

SF: You're going to have to tell me what that means.

JC: Certainly. Rather than just identify that cocaine originated from the nation of Colombia, we now have the ability to determine where the coca leaf grew down to 16 sub-regions within the nation of Colombia, two sub-regions within the nation of Peru, and one region within the nation of Bolivia. It was the culmination of 13 years of research, and it's pretty exciting results.

SF: Tell me what that means to a case, for example, that's happening on the streets of America, where a sample is seized as part of an investigation.

JC: We think it's very granular intelligence coupled with investigative information. You can actually trace the origin of that seized cocaine from Southern California all the way back to a department within the nation of Colombia.

SF: Wow. That's amazing.

JC: Yes.

SF: How big is the laboratory staff?

JC: My table of organization goes to 71 personnel. So we have a big staff of forensic chemists. And there are senior research chemists on staff as well that are program leads for the special programs. And they oversee specific research elements and run the drug signature programs.

SF: And you guys analyze hundreds of samples, thousands of samples?

JC: Thousands of samples a year in the special programs and then some law enforcement support as well.

SF: That's incredible. Do you all provide support to state and local police, or is it simply DEA investigation?

JC: We provide support to state and local police by virtue of conducting forensic chemist seminars, in which state and local chemists come in and spend a week here.

SF: The science must constantly be changing. The equipment must constantly be changing.

JC: It does.

JC: Technology advances very rapidly.

SF: Wow. That's incredible.

JC: It allows us to do our jobs more efficiently and better exploit intelligence from drug samples.

SF: Wow. Thank you very much for having us here today. I appreciate your remarks. Ladies and gentlemen, the Director of the DEA Special Testing and Research Lab, Jeff Comparin. Thank you, Jeff.

JC: You're welcome.

SF: We're going to pivot now and talk to some of the front line forensic chemists that do work here at the DEA Special Testing and Research Lab. I want to go ahead and introduce them both as we get started. The first, to my immediate right, is Dr Ed Franzosa. Hello, Sean.

SF: Good day, sir. How are you?

ED FRANZOSA: Doing well.

SF: Wonderful. Let me give a little bit of background on-- may I call you Ed?

EF: Sure.

SF: OK, great-- on Ed. He received a Bachelor of Science degree in chemistry-- I'm not going to give the year-- from Rensselaer Polytechnic Institute in New York, served two years of combat duty in Vietnam as a US Navy officer, five years as a police officer in New York. Dr Franzosa received a doctorate degree in physical chemistry back in 1975 from SUNY Binghamton and then started working for the DEA at our Special Testing and Research Lab in 1975-- 40 years on the job. Welcome today.

SF: Let me go ahead and also introduce your colleague, forensic chemist Jackie Brown-- Jaclyn, but I'm going to, if you don't mind, use Jackie-- Jackie Brown.

JACLYN BROWN: That's fine.

SF: Jackie graduated from the University of Maryland with a degree in chemical engineering. She worked at the US Naval Research Laboratory in Washington, DC doing materials research for a number of years, then six years at the US Naval Academy as a chemist assistant in their analytical and organic teaching lab-- that sounds fascinating-- but then started with DEA back in 2011 here at the Special Testing and Research Lab. And she's been working on the methamphetamine profiling program.

SF: And hopefully, Jackie, if we have time, you're going to-- you could tell us a little bit about that. Ed, I'm gonna start with you, though.

EF: OK.

SF: 40 years on the job-- I'm thinking that what we do at the DEA labs today is a little bit different than it was in 1975.

EF: Quite a bit different.

SF: Give us some examples.

EF: OK. The key word is electronics. When I started in '75, pen and paper was the method of reporting and controlling samples and everything else. The machinery didn't generate an electronic file. It generated a piece of paper with a line on it. That was called a "spectra."

EF: And we would fold that up neatly and put it in the case file. We would-- chronology of a sample-- we would go to the vault-- we would get the paperwork from our supervisor, go to the vault, sign for the evidence and so on. And there were little cards. And there was this big green ledger and so on. You'd take the stuff, go out, look at the paperwork, open up the evidence, start doing analysis.

EF: And we had one sheet of paper. We tried to put everything on one sheet because back in those days, brevity-- the shortest report was the best report.

SF: And why is that?

EF: Because when you went to court, then the defense attorney didn't have much question to you on. And, you know, the goal was to get into court, tell the jury what was present, and get back out again. So we would fill out the front of our form, and on the back, scribble a couple of cryptic notes on what we did.

And so I do the analysis, fill out the report, take the evidence back to the vault, sign the 307 card again, fill out the big green ledger, and then we were done. And nowadays, all this is done electronically. We had no computers in the laboratory, except for one big huge one that filled up a whole room.

SF: I was going to ask you-- tell me what you mean by "big huge," because today computers-- an Apple watch can be on your wrist.

EF: OK. This was-- you know what a rack is, 19 inches wide?

SF: Sure, yeah.

EF: Five of those with big fans on the top. And then the printer-- instead of being the nice laser jet of today, it was actually a teletype printer like Western Union used to make telegrams. And the computer wasn't very effective. Its entire memory was 8K-- eight kilobytes. You've got smart watches that have megabytes of information on them. So this was really primitive.

SF: Was the science, though, the same-- that the core of what Special Testing and the DEA labs in general were trying to do in '75 the same as what you all are doing on the job today?

EF: Yes, the infrared spectroscopy, gas chromatography, mass spectrometry, those methods are used then and now. The difference is the equipment is computer-controlled now.

SF: We're seeing some of that, by the way, behind us today here in this laboratory.

EF: But back then, knobs, switches, dials, and so on-- you would go to an instrument, put a big sheet of paper on this big drum, set the various conditions, and then run the spectra. And then you looked at the paper and you had to interpret it, which compound was that, what's there, and so on.

EF: Nowadays, electronically you set it up with the computer, you tell the machine what parameters to use, and so on. But it's got a memory. And it's got the spectra in it.

EF: So you go click, click, click. There's the spectrum on the screen. And poof! It says that's methamphetamine. That goes into the report automatically-- electronically. We had to scribble it.

EF: So the computers and just all of the electronic parts, the machines are-- we also have auto samplers on the machines. Now that's a device that you don't have to be there. You put a couple small vials in. It picks up the vial, it sticks a needle in, pulls some out, puts it through the instrument. It goes to its memory-- what method am I going to use? You've already entered that, and so on. And you get data.

EF: But you also get a lot more paper. We go through reams, cases. We buy paper by the pallet, 75 cases at a time. And reports are now that thick instead of being that thick--

SF: But are they giving you more information than back in 1975? Give me some examples.

EF: OK.

Then versus now.

EF: OK, back then, we would say there's heroin hydrochloride in the sample, 37%. Now--

SF: What's the 37% stand for?

EF The purity of the heroin, that by weight, the sample is 37% heroin hydrochloride. Now the instrument calculates the uncertainty, the range of values. It will sit there and it will tell us all the other ingredients and so on.

EF: Jeff mentioned that we have signature programs-- that data is transferred over to those computers. And they can generally tell us where that sample originally came from. Is it Southeast Asian or Mexican heroin, and what other cases are similar. All that's stored in memory and is available. So the power of what we do has increased greatly.

SF: How many folks were on the job in the lab system when you started in '75?

EF: 15 with one lady.

SF: OK. And today?

EF: Oh, we've got about 50, 55 chemists. And more than half of them are ladies.

SF: Wonderful. Where did you get your training when you got on the job at DEA for the labs?

EF: In the lab.

SF: Talk about that.

EF: O-J-T, on-the-job training. I was in a small group of four people. And one of the four was designated the trainer for the group.

EF: And so he then would bring me fake samples. He'd mix up things and say, OK, run this through your microscope. I was a microscopist. I used a microscope to do my analysis of the ingredients.

EF: And so first simple mixtures of one or two ingredients. And then more complicated. And then actual samples, the leftover material from an analysis-- did I get the same results as he did? And why not? And so on, until finally, I'm co-signing examples, and then, OK, you're on your own, sink or swim.

SF: How long did that take to go from--

EF: Ooh, nine months or so.

SF: Are the drugs that are sampled and analyzed today different than they were when you started?

EF: Yes. Back then, well, we had methamphetamine and amphetamine, which we still have today. We had things like LSD. LSD is pretty uncommon today.

EF: And then, for a period there, quaaludes-- that's methaqualone. That was a very popular drug, more popular than marijuana for awhile. And so we did thousands of samples of those. And that died off. And Ecstasy started up. And that went through several waves of production.

SF: Fascinating. Jackie, I want to come over and talk to you for a little bit about moving into a more modern, contemporary look at the labs. Not that it's not important to-- and it's important to note Ed is still, 40 years later, on the job doing active analysis and work. That's incredible. You deserve a medal.

JB: Tell my boss.

SF: Jackie, talk about what contemporary safety-- how that has changed, how the equipment today is different. Talk a little bit about the lab system.

JB: OK. One of the big differences-- and Ed alluded to this-- was everything is electronic now. So in our laboratory system, we have a laboratory information management system-- or LIM system-- and evidence is logged into the system when it comes into the laboratory.

SF: How does it come to the lab, for those who aren't familiar with that?

JB: It can come two ways. Either it can be hand carried by an agent, or it can come by registered mail. And then, once it gets into the laboratory is entered into the vault by our evidence specialists. And they use the LIM system to do that.

JB: It's then assigned to a group and supervisor, who will then assign it to an actual chemist, who can then go to the vault and check it out electronically. You enter a password into the system. And the evidence is yours.

JB: And then you take it to your bench. And everything that you do who generates-- or every test that you add generates a bar code. And that bar code is used to transfer the data from instruments and balances electronically into the LIM system.

SF: How long-- and I know it's difficult to do an average, but how long does it take, from the time a sample is sent to the lab for analysis, until it's analyzed and a report is available to the intelligence folks or the agents doing the investigation?

JB: That's kind of a tricky question. We have a backlog right now. So evidence that comes into the laboratory can sit for several months unless it's a rush case. But typically from when an analyst checks out evidence to when they complete the report, it can be one to two days, depending on the type of sample. If it's a large exhibit with many sub-exhibits, it can take several days.

SF: How many different analyses are used on these different samples?

JB: We tend to follow the SWG drug, or the Scientific Working Group for the Analysis of Seized Drugs recommendations.

SF: Who are they?

JB: They're a working group of scientists that set recommendations on how to do analyses for analyzed drugs-- for seized drugs. So we'll do multiple samplings and then multiple uncorrelated techniques. So we'll do gas chromatograph to get a retention time match for a sample.

SF: And what is a gas chromatograph?

JB: It's an instrument that separates the components of a mixture. So it has a column in an oven. And it heats the oven. And then, when the sample is injected, it's vaporized. And then you can get results from that. We'll also do a confirmatory technique like infrared spectroscopy.

SF: And what is that?

JB: [LAUGHTER]

SF: Forgive me.

JB: It's a technique that works by shining light at a sample. And then it gives something similar to a fingerprint that is unique and reproducible to a sample. And we have libraries that we can match our standards to-- our samples to.

SF: Who maintains the library?

JB: We do. We add samples to the library once they've been certified as authentic reference material.

SF: And who certifies?

JB: This lab certifies samples or standards. Standards can also be certified at field labs if they've come from a reputable source.

SF: How does the work done here at the Special Testing and Research Lab differ from the work that's done at the DEA labs that are out in the field division regions around the country?

JB: I think the biggest difference is in the field labs, chemists can see any variety of drugs and any kind of conditions. So it could be bulk seizures, liquid seizures, it could come packaged in any various ways. At this lab, we typically work in a one-drug group.

JB: Like I'm in the methamphetamine group. And the majority of the samples I will see are always methamphetamine. And they come to us in-- prepackaged nicely by our field chemists in nice little vials. So we can analyze them according to our protocols.

SF: Are forensic chemists here at the Special Testing Lab generalists or are you often-- like you said, you work a lot on methamphetamine analysis-- do you train to be specialized with a particular drug?

JB: Yes. Once we complete our general training as a forensic chemist, we then get specialized training for our individual groups.

SF: Go back for a minute to the history. Jeff mentioned at the beginning that the DEA laboratory network is accredited. Were the labs always accredited?

EF: No, the accrediting body didn't even exist in 1975.

SF: OK.

EF: That was something that came out of meetings of scientists. The chemists-- the forensic chemists have regional meetings and national meetings and so on. And it was a result of a study done by LEAA, the Law Enforcement Assistance Administration-- a government group that doesn't exist anymore.

EF: But they did a study on the feasibility of testing laboratories as to their ability to do analysis. In the process of doing that, they sent samples out. And they were just learning how to do this. A lot of their samples actually turned to mush and so on in the mail. It was because they didn't know how to do this. But the drug samples-- some of them came back with very good results, and some of them not so good results.

EF: So then people discussed that at the meetings, and decided well, there should be some sort of a testing organization. That became the ABC, the American Board of Criminalistics. And they developed LAB something or other-- Laboratory Accreditation--

SF: We have no shortage of acronyms in the federal government.

EF: --Board. And those are the people that are now going out and accrediting labs. They are also--

SF: How often does it have to happen?

EF: Every five years. But there are-- every year, there are intermediate, brief inspections. So every fifth year, you get a major inspection. And they review cases and go around. They talk to the chemists, they look at maintenance books and things like that.

EF: This is all so that when the chemist goes to court, and the judge or the defense or prosecution says, well, you said this sample had heroin-- how do you really know that? Well, there's the basic science. But there's all the policies and procedures, maintenance, periodic testing, blank samples and so on that we do to guarantee that the results are what we're going to testify to.

SF: So we've got standards that the laboratories have to go through for accreditation.

JB: Yes.

SF: Does that include safety protocols? Because, I mean, let's be honest. You guys are dealing with some pretty dangerous chemicals, things that could cause harm to the forensic chemists that are doing analysis, let alone the chemicals that are being used to do the testing on the drugs. Talk about that for a little bit.

JB: We've vastly improved our safety protocols. So in the laboratory, all of our chemists are wearing goggles and lab coats like Ed and I are today-- and your lovely pair. We're also wearing gloves. But we're wearing respirators now. We're wearing masks-- facemasks-- to protect us from the particulates of the drugs we're dealing with.

JB: One thing that's changed is that we have a lot of new, emerging synthetic drugs. Some of them are very dangerous, specifically fentanyl. Fentanyl we're seeing a lot in heroin samples and also on its own. We're seeing seizures of kilogram quantities of fentanyl, which is highly toxic.

JB: And so we want to be careful with our chemists inhaling anything. And then also solvents that we're using we know can be harmful to our health as well. So we're taking safety very seriously in the lab system.

SF: And that has changed.

EF: Oh, immensely. When I started, we had gloves. And we had the face mask. But we only used them if the sample was large and fluffy and as we opened it up, it was going to spray dust all over the place. The biggest change, though, is in the solvents we use. Back then, benzene, toluene, trichloroethylene, carbon tetrachloride--

SF: They all sound really good for you.

EF: Oh, they're wonderful. They're carcinogenic. And so--

SF: How are you feeling?

[LAUGHTER]

EF: I got a little pain.

SF: They've changed the solvents.

EF: We've eliminated them. We've found different methods or changed extraction procedures and so on. So we don't have to use the solvents that are more dangerous. Each solvent-- water is best, but you can't use water very much. It doesn't go into these pieces of machinery well, and so on. We use methanol and a couple of other solvents. But we've learned to be more careful.

SF: Trial and error?

EF: No, there's OSHA, and NIOZ

SF: And what are those?

OSHA-- Occupational Safety and Health Administration.

EF: OK. I forget what NIOZ stands for, but it's another one of those--

SF: Government agencies that set workplace standards.

EF: Yes. And we get training every year. We have to train in blood-borne pathogens. That's the AIDS virus and hepatitis and so on. And then there is the kinds of equipment that we can use and how to use them. We even have-- they look like SCUBA tanks, but they're self-contained breathing apparatus. And we have those for if we have a fire or whatever.

SF: Jackie, what kind of background does DEA look for when hiring new forensic chemists?

JB: The basics that we look for is a bachelors degree in a chemistry field or a science field.

SF: Sure.

JB: Obviously, if you have a masters or PhD, that's even better. If you have a focus in forensic science, that's good, too. But we will accept people with bachelors in a science degree.

SF: Let's talk about that signature program. Jeff, the director here at the Special Testing Research Lab brought it up in his opening remarks, mentioning that there's a cocaine signature program. Are there other signature programs?

JB: Yes there are. There is a methamphetamine profiling program, heroin signature. And then we also have an emerging trends group that deals with new synthetic drugs. In the past five years, they've identified over-- the lab system has identified around 300 new synthetic drugs.

SF: And more and more every day.

JB: Yes.

SF: Back to methamphetamine for a second. And some of our viewers are probably familiar with meth, maybe having just watched Breaking Bad in the last couple years. What is the methamphetamine-- it's not signature program--

JB: It's a profiling program.

SF: A profiling program. Tell me what that is.

JB: Basically, we work to determine how the methamphetamine was made. So as opposed to cocaine and heroin, which come from a natural source, the coca leaf and the opium poppy, methamphetamine is fully synthetic. So we can determine how it was made. Maybe not where, but how it was made. And then we work to make sure we can monitor precursors to methamphetamine. So we can monitor where it's being made.

SF: And then all of that information is sent to our Intel folks?

JB: Yes, we create a quarterly report that is delivered to our Intel division.

SF: Fascinating. That's--

EF: A lot of the people that make methamphetamine are taught by other people that have made methamphetamine. And so there become Traditional methods in different areas--

SF: I think we saw that in Breaking Bad if I'm not mistaken.

EF: Well, there are more than one way to make the synthesis of methamphetamine. And certain areas seem to favor one method over another. Now, this doesn't guarantee--

SF: Certain parts of the world or parts of the country--

JB: Certain parts--

EF: --East Mexico and West Mexico appear to use different methods. And so we've determined that a method was used doesn't guarantee that it came from Baja, California, or something like that. But it's a good indication that it probably came. And that's helpful for the agents and so on.

SF: Reporting requirements-- you'd talked about different ways of providing digital reports and now. But how have the reporting requirements for what happens at the labs changed?

JB: One thing that's changed is we're now reporting uncertainty for our net weights and our purity results.

SF: Tell me what that means.

JB: So, for every measurement, there is some level of uncertainty. And that's because our samples are unknown. So we don't know the true value.

JB: So a sample comes in. There's no way of knowing what the true weight is. And if you were to weigh it multiple times, you would get slightly different weights every time. And so what uncertainty does is provides us that range of values which we know that the true value lies in. So it actually provides a range of certainty for the values.

SF: And is that helpful? How is that helpful?

JB: It gives more information to the end user, to the end consumer.

EF: Think of it this way. If you were to scoop up instant coffee multiple times, you would have a different amount of instant coffee in your spoon each time. So we're weighing things. And this is a way of getting a scientific number as to what the range is, what's the variability.

SF: Fascinating. You mentioned backlog. Too many drug samples coming in from too many places to just handle at once?

JB: We've had a large amount of samples coming in from certain operations that we've done around the country. In addition, we've lost some chemists. So that is a part of it as well. But our new reporting procedures and our new electronic system sometimes can slow us down a touch. So those things all get into-- a touch--

SF: Yeah, I understand--

JB: --and creating our backlog.

SF: You guys here at Special Testing-- unlike the regional laboratories that are pulling samples from a few states-- you all actually also provide sampling analysis for investigations all over the world, is that correct?

JB: That's correct. We can receive samples from our foreign offices. And sometimes we are asked to come out and assist in seizures or clandestine laboratory investigations at our foreign offices as well.

SF: Has that changed? Have we always done international support?

EF: Yes, we've always had agents in embassies around the world. What has changed-- well, the number of them, that's decreased regularly-- but the kinds of services that we share with the foreign countries has increased. They will send people here. They will like the results. They will want to get the results themselves.

EF: So they will send their chemists here and we will teach them these signature methods and so on. So they can go back home and do it. And then we can compare our results with their results.

SF: You bring up a good point, and that's teaching others how to do what you all do. Jackie, is there any lab like this anywhere else in the world that does this kind of work?

JB: There are several labs-- but they're not quite like this one-- but there are labs in other countries that do similar things to what we do.

SF: But this is kind of the gold standard, if you will?

JB: Yeah.

SF: Fascinating. I want to kick it over to Catie Drew, who's our educator, and find out if, as we've been going along, there was an opportunity for folks who are watching on the webcast to be able to offer questions. Catie, you've got a couple of questions you want to kick over to us?

CATIE DREW: Sure. One of the questions was, how has the media and entertainment portrayal of forensics affected your job?

SF: OK, this is-- I knew this question is coming. This is the CSI question. Everybody watches television and there's CSI Vegas and Miami and New Orleans. OK, truly, can it be done in 40 minutes with commercial breaks?

EF: No.

SF: OK, Ed, no. And Jackie?

JB: No. First of all, it's far too dark in the laboratory. They need to turn the lights on--

SF: On television.

JB: Yes, it's very dark. And then--

SF: You wouldn't want mood lighting?

JB: No, I like to see when I do things. I like to see.

SF: But lighting is important.

JB: Yeah.

SF: Why?

JB: Basically, we have to be able to see what we're doing. We're pulling sample, we're weighing out sample.

SF: So this may not be the most flattering light, but it's about safety--

JB: --but it's useful. Yes, it's about safety.

EF: You don't want to trip over things.

SF: What else is--

EF: We don't have glass walls. If you look around, there they have these beautiful things. Also, they don't issue us Hummers.

SF: Not that you're bitter that you didn't get a Hummer to go to the crime-- Do the forensic chemists actually go out to scenes or is the evidence brought to the labs?

JB: It depends. Sometimes we'll be called out to support at, like I said, a clandestine laboratory investigation or at a large seizure. But typically most of the evidence is submitted to the laboratory.

SF: How does the science on television shows and movies that look at lab analysis compare with the real thing that happens in our labs?

EF: The basic science is the same. The applications, the efficiency of the equipment, the speed of the analysis-- I mean, they do a DNA analysis in two minutes. And the instrument doesn't give you a spectra of DNA alleles, it tells you, well, it's John Jones. And he lives at 501 Peacock Drive. And he's got two children, a boy and a girl, and he drives a Maserati with license plates so on. That part is--

SF: --not so accurate.

EF: Not even close.

SF: Jackie, you wanted to say something?

JB: I think a lot of times the science is good. But then they kind of confuse things. So they'll say they're going to run something on a gas chromatograph. And they get a result.

JB: And I'm like, you can't do that. That's not going to tell you that. So one episode of a show I shall not name, where they scrape the body with a needle, they do a manual injection on a GCMS--

SF: Wait, GCMS?

JB: Gas chromatograph mass spectrometer.

SF: OK, thank you.

JB: And then they said that it was copper. And I was like, what? How'd you get that?

SF: Because that machine doesn't test for copper?

JB: Right. Doesn't do that.

EF: Some of the machines that they stand in front of aren't the machines that they're verbally saying. I'll take it over to the chromatograph. And instead, they take it to a spectrograph or something or other.

SF: But it looks good on television.

EF: Very good.

JB: Looks good.

SF: So we've got some equipment behind us. Some of it's actually running, which is part of the noise issue. Some would say even this stuff is big. But you actually have even smaller units than this now. Did you want to show us some examples?

JB: Sure, sure.

SF: Let's move up here to the counter.

JB: So we talked about clandestine laboratories. So when we're out in the field, what we used to do is we used to use color tests in these little pouches. And we would test substances.

SF: And how does that work?

JB: So you basically you take the top off. And you add your sample inside, and then you break the ampules inside that have chemicals. And they'll react and give you a specific color.

SF: And the color it changes would indicate what drug you're dealing with.

JB: A class of drugs--

SF: Class.

JB: Not specific, but it could tell you if it's amphetamines or opiates or--

SF: Ed, how long have those kinds of tests been used?

EF: We've had them ever since I started.

SF: OK. Still used today?

JB: Agents still use those in the field, yes, if they're-- that's what they usually have at their disposal. But we are fortunate enough in the lab system to have portable instruments such as these. So this is a Raman and this is the portable IR.

SF: So Raman-- what does that stand for? Or what does it mean?

JB: Raman.

SF: Like ramen noodles?

JB: R-A-M-A-N. And this is an infrared spectrometer. And so basically you can put your sample into either of these and it will give you an identity. So it will give you a name of what the compound is that you're looking at. If it's a mixture, it can give you kind of options for what you may have, but it's not as precise as if it were a--

SF: Who operates these?

JB: Chemists usually. Some of our other agencies use them in their fieldwork as well. So it's not just DEA.

JB: The results, though, are they definitive and that's what we're going to use? And that's what we're going to stick with? Or this is kind of front line?

JB: This is still front line, so you would use this to determine do I need to sample this, is this something I want? And then you would sample it. And then that would, again, be sent to the lab for complete testing.

SF: A little different than 1975.

EF: Oh, yes. Back then we had-- well, you see the vial. We would take this spot play, put a little bit of the powder in, and add a reagent to it. So we made up our own little kits, and took them out, then brought them back, and so on.

SF: Expensive units?

JB: Yes, they can be.

SF: But what do they do? What does this big yellow guy do?

JB: So this is an IR. So you add your sample to the sampling plate. And then, again, it works by shining light.

JB: And then that light is either transmitted or absorbed. And it will give you spectra. And you can match that to libraries that-- you can buy libraries or you can create your own by running standards--

SF: Tell me what you mean by a library.

JB: Basically it's just a database of compounds that have been run. And so there's an algorithm that matches the compounds and the bands that are observed to what your sample has.

SF: And you guys maintain libraries or you buy them or a little bit of both?

JB: We buy them, but we also add our own. So for a lot of the new compounds,

SF: Are you talking about like these new synthetic drugs?

JB: Yes, so like synthetic cannabinoids, the cathinones, the new hallucinogens--

SF: Right.

JB: We can run those--

SF: Folks might know those by the nicknames like K2--

SF: Spice.

JB: Spice.

JB: Bath salts, yes.

SF: Flakka-- is that one of those?

JB: Flakka could be considered one of those, yeah. And so we'll run known standards. And then we'll add them to our library so that we can test safely to determine how to sample.

JB: So what happens if a sample is sent in from a field division and it isn't in the library? It's unknown. It was shown to have had an adverse effect on a user or was being traded as drugs, but it doesn't show up in the library.

JB: Well, at that point, we would begin our structural elucidation. So--

SF: Ooh, fancy words.

EF: Oh, yes, a lot of work.

JB: So basically we use NMR-- nuclear magnetic resonance. You do 2D and 3D experiments to help determine the structure. We use our mass spectrometer results and our IR results as well to basically determine how the molecule was put together.

SF: The molecule's right here. And then what you all find, do you share that with others?

JB: Yes. We will share them with other groups and people. And we also work with field labs as well.

EF: And we have the DEA lab notes in "Microgram." "Microgram" is available on the internet. So that's a monthly-- "Microgram" comes out every month. And it's a report of what's being seen. So it's kind of like--

SF: Trends.

JB: Yes.

EF: Yeah. It's what's new in the street world and so on. And we include methods of analysis and structures and the numerical data and so on.

SF: I'm noticing there's this thing that looks like someone's high school science project. Can you tell us what this is?

JB: That's a capillary column that we use in a GC, a gas chromatograph. That is actually 30 meters of column.

SF: 30 meters.

JB: Yep, it's just wound up. And we'll use this in our analysis to separate the components in a mixture.

SF: How does it work?

JB: So this goes into an oven. And then, when you inject your sample into the injection port, it vaporizes. And then it's pushed onto the column by a carrier gas. And then it just-- interactions between the sample and the column cause the components to separate at different rates.

SF: Still used today?

JB: Yes.

EF: The different compounds have different affinity for the solid phase inside the column. So they come in together, but then they start to spread out. We can have complete separation. That is so much more efficient than when I started. We had six-foot packed columns.

SF: What is that?

EF: That's a hollow glass tube six foot long. And we would have to pour the stationary phase in and tap it so it would pack together. We remade these columns every week, sometimes more often. They weren't stable. And they broke up. And sometimes we'd drop them.

JB: And so we've even gotten a little more technologically advanced than this. And we now have low thermal mass columns where the column itself is heated. So it allows for more efficient heating and faster analysis time. So analysis that took 10 minutes with a regular capillary column could take three minutes with an LTM column.

SF: Obviously the technological advances are helping to make the test more accurate and happen faster.

JB: Correct.

SF: And then it's the paperwork that gets added on that then slows it back down again.

JB: Yes, it all balances out.

[LAUGHTER]

SF: And tell me what this is. This looks like something from a science fiction weapon.

EF: That's the core of a mass spectrometer. The material is going to be injected into it. The molecules are broken into fragments. Then you have a magnetic-- electromagnetic field here. Because the particles have a charge on them. They'll spread out.

EF: And then you can then analyze the individual fragments and get a characteristic spectra for the substance. But that will be after a chromatograph. So the chromatograph separates the components of the mixture and then that breaks it up and gives us the unique spectra, the fingerprints of the individual components.

SF: How often does the equipment that you all use change, and-- one. And two, how do you keep up with and continue to learn how to use 2.0 and 3.0 and 4.0 as it advances?

JB: Equipment changes fairly quickly. I'd say every five years we kind of upgrade our equipment. And a lot of that has to do with our vendors.

JB: We have them come in. And they teach us how to use it. And then we spend a lot of time in house perfecting methods that we can use and then training each other on how to use it.

SF: Fascinating.

EF: They'll even lend us new models of equipment, sort of test driving for six months or something or other. Then we will go back to them and say, well, we don't like this, but that part was good. And you know, you guys should make a library and so on.

EF: So it's a cooperative effort. And it's not just us. Some state and local agencies do this, too.

SF: Because others have crime labs.

JB, EF: Oh, yes.

SF: Are other crime labs doing the kind of drug testing that you all do?

JB: Yes, for the most part.

SF: Just not it as-- at the same volume.

JB: Right. And, I mean, they do the same type of work our field labs do, where they're identifying compounds. They typically don't do purity determination as often as we do.

SF: And they certainly don't have the signature programs.

JB: Correct, correct.

EF: And they don't have the most expensive-- some of our instruments are a million bucks each. That's a little hard for a state or local--

SF: To absorb.

EF: --the crime lab to pay for.

SF: Let's take a seat again. And we're going to kick it back over to Catie. And I think we may have a couple more questions to ask before we wind things down. Catie, do you want to kick us a question or two?

CD: Well, actually, you may have answered one of these. A question came in that says, how do the laboratory select the various equipment or tools that are used?

SF: So let's start with Ed first, the old way it was done. Let me repeat the question. How did the labs select the equipment that was being used to do the tests?

EF: When special testing started up, it took people from the Food and Drug Administration, who had been working on analyzing samples-- the predecessor to DEA was called BNDD, the Bureau of Narcotics and Dangerous Drugs. But their predecessor was ODAP and ODALE, Office of Drug Abuse Policy and Office of Drug Abuse Law Enforcement. Those people didn't have laboratories. So they basically contracted with the Food and Drug. So our first instruments were basically borrowed permanently--

SF: From FDA.

EF: --from FDA.

SF: And today?

JB: And today we purchase our instruments. We do bidding. So we say we would like an instrument that can do xyz. And we send out-- let the people bid on how much they will charge us for x, y and z. And that's how we select our instruments.

SF: But you are still drawing from a core of certain kinds of instruments that, A, do the tests that you want to be done, and B, are known to be effective, so that when you're putting this evidence for court together, or information for the intelligence, you get good reports.

JB: And that hasn't changed. The infrared spectroscopy is still the same.

EF: Chromatographs--

JB: Yeah, that's still the same.

EF: The gas chromatographs, the liquid chromatograph, the mass spec, the mass spectrometers and infrared, they are the same techniques I started with. They're just better. They're more efficient, they're more accurate.

JB: Our sample introduction is much easier.

SF: Tell me what you mean by "sample introduction." Hi, nice to meet you. Welcome to my lab. I'm about to pick you apart.

JB: So how-- sample introduction is how we add-- get our sample onto an instrument. So we talked about GC and you take a liquid, you inject that into an inlet port. With IR, you still have to use KBr pellets and new gel molds. And now we have ATR-- Attenuated Total Reflectives-- which, basically, is just a sample plate with an anvil. And so you can place the sample on there directly and apply pressure and then you can run your tests. And it's very fast.

EF: The KBr pellet refers to-- KBr is potassium bromide. It's a salt that's transparent to infrared radiation. So you would take the drug at 1% the weight. And you would make a pellet-- it's about 1/2 inch in diameter, a 16th of an inch thick.

EF: And you had this big press-- hydraulic press-- and you would press the pellet and then very carefully take it over to the instrument and put it one of the beams. Now these devices you see sticking up, they-- we put a whole bunch of vials in there. And they rotate and move. And it picks them up and puts them around--

SF: Automates it all.

EF: Automates it all. And it puts a flushing solution through to clean the instrument, and then a blank solution to show that there's no other drugs present in the instrument. So there's no question of contamination. Then it injects the particular sample. And it does that again and again.

SF: And all of these steps are inspected as part of your-- I assume-- re-accreditation process to make sure that everything that's coming out of the labs is exactly what you all are saying it is. Fascinating. Catie, another question?

CD: We do have one more question. Have you ever heard of the seizure of six kilograms of crack cocaine in six kilo packs?

SF: Repeat the question, Catie.

CD: Have you ever heard of the seizure of six kilograms of crack cocaine in six kilo packs?

SF: So an entire six kilo quantity of crack cocaine seized all at once?

EF: I wonder if that means that the crack cocaine was somehow put inside the cocaine bricks?

JB: I think-- I don't think that's what they mean. I think they mean in general--

SF: Large quantities.

JB:--these large seizures that are packed in kilo packs. So yes, yes. We have seen seizures like that.

SF: Talk about for a second the quantities of drugs that you're dealing with that-- when a sample arrives. Because you had mentioned earlier, I think, that back when the equipment wasn't as sensitive, you needed to test a very large quantity of drugs to get the sample. And today you can test a lot smaller.

EF: Yeah, within reason the amount that comes to the laboratory-- 5 grams, 25 grams, or maybe 5 tablets or 100 tablets or whatever-- it is an amount that conveniently fits in a hand. And of that, you then sort it out, and you take a representative sample. The GCMS-- the gas chromatograph mass spectograph-- is microliters, millionths of a liter injected into it.

EF: That KBr pellet I spoke about was a milligram. That's a thousand times as much. But still, a milligram is a small amount of material. It's like one grain of salt or sugar.

SF: So even when DEA seizes an entire boatload of drugs, for example, off the coast of Florida, you all are still only getting a small sampling. They don't actually ship the entire pallet to you.

JB: Sometimes they do.

SF: Really? Why?

JB: So that we can package it up. And then we can-- we have to sample from multiple bricks. It's part of our sampling plan. Like SWG drug states, we use hypergeometric sampling, so--

SF: Hypergeometric sampling, which means--

JB: It gives us a basis on which to sample-- a statistical basis. So we can then say if I sample a certain amount of bricks, then I know that this percentage of the whole exhibit is the same, as opposed to say, sampling every brick, which would be a lot of work. So we do that, so we can select the bricks for that. But we only take a small portion. A typical analysis may use like four to 500 milligrams in total here at the lab, so small amounts.

SF: Ed, any closing thoughts on the evolution of forensic sciences for DEA and the laboratory system?

EF: Well, as I said in the beginning, electronics, the use of computers. And telephones are much better. We used to have these black things with a handset and a coil cord and so on.

JB: You know they still have those, right? There's one right over there.

EF: Ah, but they've still got push buttons. We had the dial, the rotaries.

JB: The rotaries.

EF: And communications have changed. We have improved. We just have more ways-- I can communicate directly with an agent.

EF: Back then I had to write a report. And it had to be typed, then approved, then mailed. And then it went not to the agent, but his boss two levels up and trickle down. Now I just get on the Firebird system and--

SF: You're emailing.

EF:--and email directly. And he can email me. What the hell does this mean? Oh.

SF: And how has that helped?

EF: Well, we get better communication. We get faster communication. But we also can communicate with more people in a short period of time.

EF: So if there are multiple agents in different offices working on one large case, we can communicate with all of them at once. And they can then communicate with each other. Better than a telephone conference call.

SF: Real quick before we ask Jackie for a modern update, talk about-- you said earlier that the laboratories were set up and a lot of stuff was borrowed from FDA. What caused the decision to have DEA set up its own set of labs, as opposed to use other peoples' labs?

EF: All right. President Nixon was elected in 1968. And one of his things was the "war on drugs." So he created BNDD.

EF: When he was re-elected in '72, the war on drugs was still a major thing within the presidential campaign. So, to improve it, he said, we're going to take the BNDD and other people and make a new agency called DEA. So DEA started in 1972.

EF: And, at that point, they said, you know, we should have our own laboratories. And we should do our own analysis. It will be faster. There will be better communications. And it was. It did make a major improvement over what they had been doing before.

SF: Great, Ed. Thank you. Jackie, any closing thoughts?

JB: I think the DEA lab system has come a long way. But we're still progressing. We want to improve. So it's an exciting time to be at DEA.

SF: I want to close by thanking Director Jeff Comparin and the staff here at the Special Testing and Research Lab for hosting us, certainly the Office of Forensic Sciences. We hope that, by giving you an inside look at a lab-- even though we can't tell you exactly where it is-- that you have a better appreciation for the science that is at the backbone of a lot of what DEA does. And perhaps you can find out more by visiting us at our website deamuseum.org. Thanks for joining us.