***Oklahoma Innovations* Radio Show**

Air Date: November 21-22, 2015

Guests: **Thomas Kupiec** and **Brandt Cassidy**, Analytical Research Laboratories and DNA Solutions

>> From the OCAST Radio Network, this is *Oklahoma Innovations*, a weekly science and technology radio magazine, brought to you as a service of OCAST, the Oklahoma Center for the Advancement of Science and Technology. OCAST is the state's only agency whose sole focus is science and technology. The OCAST mission is to identify and fund promising research and technologies that allow Oklahoma to compete in a global market economy from our own backyard. This program features some of Oklahoma's most gifted scientists, inventors, entrepreneurs, manufacturers, educators and business leaders who all have one common goal: developing technology based economic growth for all Oklahomans. Now, here are your hosts Gary Owen and Tessa North.

[Music]

>> **Gary Owen:** Welcome to this week's edition of *Oklahoma Innovations*. Gary Owen and my good friend, Chad Mullen, from OCAST and we are going to talk about something very cool today, DNA.

>> **Chad Mullen:** Absolutely, Gary.

>> **Gary Owen:** It's a really good subject.

>> **Chad Mullen:** It is, absolutely. It's something that has in probably the last 10 or 15 years become very prominent in our pop culture, in our medical lives and all sorts of things. And we have a great company here out of Oklahoma City, ARL and DNA Solutions, two separate companies that do two separate things but we're going to hear about both of those today. And we're excited to have these folks with us.

>> **Gary Owen:** Dr. Kupiec has been on our show a few times in the past and so he should be really -- you should be really experienced at this by now [laughter].

>> **Dr. Thomas Kupiec:** Thank you, it's a pleasure to be here. Thank you for the invitation.

>> **Chad Mullen:** Well, Dr. Kupiec -- in addition to Dr. Kupiec here, we also have Dr. Cassidy, who's the Laboratory Director for DNA Solutions. So, Dr. Cassidy, welcome to the show. We're excited to have both of you here with us today, and I'll just start with Dr. Kupiec. Tell us a little bit about yourself, your background, and how you came to be CEO of ARL and DNA Solutions.

>> **Dr. Thomas Kupiec:** Well, my background is actually in Forensic Toxicology. I worked for the police department for about 10 years and I worked for the Federal Aviation Administration, Toxicology Laboratory. While working there, I went back to school and got my doctorate here at the LU Health Sciences Center in Pharmaceutical Sciences. I moved to Salt Lake, was there, and then moved back to Oklahoma City and acquired a lab called ARL. And that is a pharmaceutical testing laboratory, and it has grown, and then we acquired DNA Solutions in 2000. DNA Solutions was actually started by Dr. Cassidy and a group of folks from the Noble Foundation in Ardmore and it was called Ardmore Biological Analysis, and then I acquired it in 2000 and we moved -- we changed the name to DNA Solutions. I think the name of the facility or the company should reflect what it actually does, and DNA Solutions provides solutions using DNA

technology just as ARL is Analytical Research Laboratories, it performs a lot of analytical analysis on drugs or pharmaceuticals and research. Both companies are service companies as well has an R and D component.

>> **Chad Mullen:** Oh, excellent. Now, Dr. Cassidy, tell us a little bit about yourself.

>> **Dr. Brandt Cassidy:** Yes, well I've come through a very torturous route, I'd guess you'd say [laughter].

>> **Dr. Thomas Kupiec:** -- hon?

>> **Dr. Brandt Cassidy:** No, well, just lots of twists and turns. I started my career or I got my PhD at Baylor College of Medicine in Pharmacology, but I was studying the regulation of gene expression in tumor cells. So, I've always been interested in how DNA works. After that, I actually spent about 13 years working in Plant Science, studying the regulation of gene expression in plants and agronomic crops, trying to improve their capabilities and their yield and resistance to disease and things of that nature. And while I was doing that, I was working then at the Noble Foundation in Ardmore. And as Dr. Kupiec mentioned, we started a DNA testing company called Ardmore Biological Analysis in Ardmore. So then Dr. Kupiec purchased the company, and we moved it up here to Oklahoma City, and we've just been growing ever since.

>> **Chad Mullen:** Well -- and it's a pretty interesting point you make there, that the Sam Noble Foundation, which is an agricultural sciences research institution in Ardmore and it's a great world-renowned facility, why would they be interested in DNA?

>> **Dr. Brandt Cassidy:** It's, again, the plants have DNA just like people do and it -- the DNA is going to dictate the characteristics of the individual plant. So if you want to improve the yield of those plants or make them drought tolerant, or resistant to disease infection, you can work at the DNA level to impart those characteristics or select for those characteristics by picking the pieces of DNA that give them resistance or drought tolerance or better yield.

>> **Gary Owen:** ARL, that stand for Analytical Research Labs. Who are your clients? What type of work do you do and where does that direction go? I'm very, very serious right --

>> **Dr. Thomas Kupiec:** Well, it's interesting because probably only 1 or 2% of our revenue comes from the state of Oklahoma. A large, 95-plus percent of revenue for both companies is outside of the state, which I think is positive because you're bringing those dollars in from out of the East Coast and West Coast. And we have clients from outside the United States as well, both -- for both companies, DNA. We just came back from South Africa and he'll -- Dr. Cassidy will probably speak about it. But one of our clients are hospitals, are pharmacies, are big pharma. We have private research institutions. We have private hospitals, research hospitals, some government entities. We've received -- we've been very fortunate over the years to see grants both from OCAST, from SBR, Phase One and Phase Two. So it's -- even though we're a for-profit company, we are a strong believer in innovation and collaboration and really creating that opportunities working together.

>> **Gary Owen:** Do you know how he smiled when he said, OCAST?

>> **Chad Mullen:** [Laughter] I appreciate it, absolutely. And in the interest of full disclosure, Dr. Kupiec's one of our board members, we're happy to have him on. He's a relatively new board member and has been a great asset to OCAST. Dr. Kupiec, tell us a little about this. I'm always excited to hear about life science companies, bioscience companies, just tech companies in

general that have a good economic impact on state, which yours certainly does. How many employees do you have amongst all your companies?

>> **Dr. Thomas Kupiec:** Oh, I don't even know the total. It's approximately 100. '

>> **Chad Mullen:** Yeah.

>> **Dr. Thomas Kupiec:** It's plus or minus in change there. But, you know, you mentioned OCAST and I can't help but get my plug, if that's okay, but it's one of the greatest return on investments. I mean, it's like close to 20 to 1. So those dollars do quite well when it's invested in that. And I think -- I'm a big advocate for knowledge-based companies. You know, with diversification, all aghast at what's going on today, we need to. The state does an incredible job with energy, we've done well at Department of Defense and the oil and gas, we need to diversify into knowledge-based companies. And so, I think those dollars that are invested into OCAST and companies such as that or institutions such as that does provide a great return on investment for the state.

>> **Chad Mullen:** Well, we certainly appreciate that endorsement, it does mean a lot. And ultimately, Gary, as you and I have talked many times, what we are trying accomplish is what Dr. Kupiec and his staff have done, which is to grow business, employ many people --

>> Gary Owens: Absolutely.

>> **Chad Mullen:** -- good paying jobs, a good work environment, and quality.

>> **Dr. Thomas Kupiec:** And I really can't get the credit for that, Chad. I think it's people like Dr. Cassidy, who's the brains of the -- we've been blessed. I say it's a God-thing. I think we really have good people, good leadership and it's -- that's what it's about. It's the people that make the companies and we have been totally blessed, incredible folks, and you can tell that from the type of conversation you have with Dr. Cassidy.

>> **Chad Mullen:** Oh, absolutely. Kind of while we're on the topic of the company, your company is located in the Innovation District, as it's being referred to now, which is the area, the OU Health Science Campus, the OU Research Park area, kind of the, if you will, the northeast side of the downtown corridor. Tell us a little bit about why you chose to locate here and why you choose to continue to do business here, Dr. Kupiec.

>> **Dr. Thomas Kupiec:** Well, it's a great location. As I stated earlier, most of our business is outside of Oklahoma, East Coast, West Coast, north, south, east, west Canada, I mean, Africa, other -- all over the globe -- and we're continuing to expand on an international basis. The area is -- when it first started with Stanton, yeah, I mean he was such a straight, great visionary and the address, Research Parkway, you know, it's a nice -- we were at a smaller rural area, not rural area outside, we were actually in Edmond, that's definitely not rural, in a nice facility. But we moved down here at the Research Park. At that time, it was the Presbyterian Hill Foundation. I think we had 15,000 square feet and now we probably have approximately 20 -- I'm not sure of the exact number, but close to 20,000 square feet there. And it's a great place. I mean, a lot of things are happening. It's exciting about the innovation district. I think that term in itself is not well understood by the masses. Really, Innovation is a -- District is about creating opportunities, jobs, a place to play, work, serve, and have fun in a -- more of a densely populated area. I think the boundaries for the Innovation District, we do have some -- lines that have set up, but the idea is to create an area. And it's more as a seed to grow wealth or commercialization opportunities, where great scientific minds can work and be exposed to individuals that can transcend or

translate that basic to apply research to technology -- to transfer that technology, do commercialize it, whether it be a product or a service, into the future, and that's the idea. And there's a lot of intellectual capital in this area here at the Health Science Center. And just look what's going on with Midtown, it's fascinating to see what happened with GE, the oil and gas R and D Department at that facility. I think it's close to $100 million and then look at the Boathouse District. It's an exciting time to be in Oklahoma right now.

>> **Gary Owen:** And all that seems to be growing together, it seems to be merging together as a lifestyle community as well as a working community, right?

>> **Dr. Thomas Kupiec:** Absolutely. I think, you know, traditionally, one was thinking more segregation and protection. And, you know, I'm a strong believer in integration, open culture. We have a very great -- we have great staff, great colleagues. And I think you see the opportunities that present themselves when you learn to collaborate and work together and thinking about cooperation and collaboration in order to create that wealth or those opportunities versus, I'm on my side of the fence and you're on your side of the fence.

>> **Gary Owen:** Let's talk a little bit to Dr. Brandt about DNA Solutions. Obviously, this is a highly equipped facility and processes a lot of volume, I guess, when it comes to DNA sampling. Talk a little bit about that to our audience.

>> **Dr. Brandt Cassidy:** Well, we do DNA testing on a wide variety of types of material, because every living organism has DNA in it, we're able to extract that DNA, be it from a plant, from an animal, in human cases, from things that are left behind. You can still get DNA from things once it's been deposited on something. So, that's the exciting part about DNA Solutions is we're never sure exactly what's going to come in the door. And so we have our routine testing in which we help with animal genetics. We work in the milk industry where we have a test for a specific milk protein that particular producers would like to have in their milk. So we can tell them which cows are going to produce that, just looking at their DNA, so they can get rid of the animals that are not going to produce it and so they can have a herd that produce all the best type of milk that they want. But then we also work with breeders on trying to determine who the mothers and fathers are of animals. And this has led us from working in cattle and white-tailed deer to recently, Dr. Kupiec mentioned, we just came backroom South Africa and we're beginning a registry for Cape buffalo, roan, and sable antelope where they're trying to improve the herds in South Africa by using genetic selection. So, out on the range they don't know which bull and which cow got together to produce an offspring necessarily.

>> **Gary Owen:** Sure.

>> **Dr. Brandt Cassidy:** So based on the DNA, we can identify that.

>> **Gary Owen:** We're talking with a couple of very interesting gentlemen, Dr. Thomas Kupiec, and Dr. Brandt Cassidy. We're talking about their companies, ARL which is Analytical Research Laboratories and DNA Solutions. These guys are -- they got a lot to share with us in the next hour, so stick around. We just barely uncovered what they do. So, back in a moment. When we return, on your Oklahoma Science Radio magazine, and where you can learn something every week, *Oklahoma Innovations*. We will be right back.

[Music]

>> Pancreatic cancer is the fourth leading cause of cancer deaths, the median survival rate is only six months. As an oncologist, I see far too many families suffer from the effects of this terrible disease. We need better treatment options for patients.

>> With the support of the Oklahoma Center for the Advancement of Science and Technology, the researchers at CORE Biotechnology have what they hope will eventually be a treatment, even a cure, for pancreatic cancer. They have identified a protein that, if blocked, may prevent tumors or keep them from growing. With help from OCAST and i2E, the team at CORE was recently awarded an SBIR Research Grant to enable them to continue their research and move closer to a treatment for pancreatic cancer. If you're a researcher or a small business in Oklahoma and are considering applying for federal SBIR funding, contact OCAST, toll free, at 866-265-2215 or visit us on Facebook or our website at ocast.ok.gov.

>> Now, in its 20th year, this is *Oklahoma Innovations* on the OCAST Radio Network.

[Music]

>> **Gary Owen:** DNA, we hear that, I think, every day, it seems like, whether we're hearing it in the news or we're seeing it in [inaudible] one of our favorite crime shows. It's a big deal. You know, Dr. Cassidy, I can recall when you -- a service was requiring DNA testing of some sort and it took a long time to get that back. Technology has changed all that now. You guys can turn it around relatively quickly now, can't you, as far as the results?

>> **Dr. Brandt Cassidy:** Yes, that's absolutely correct. It was a very laborious and slow process in years past, and the nice thing about DNA Solutions is we adopt these new technologies as they become available. And through validation process, we can introduce them into our quality control system and then produce results much faster, greater sensitivity, which has been very helpful in cases, especially exonerating people who, in years past, were convicted of a crime and now they're able to go back to some of that evidence. Where before they didn't have enough material to test, now there is. And you can actually identify then, the real perpetrator of the crime through DNA left behind on evidence and that's how a lot of the exonerations are being done. So it is very sensitive. And as far as the technology, in human identification, they originally looked at just a few markers in an individual to identify them, so the power of discrimination was not as good. But now we look at many more places. And, in fact, there's a company that we work with called Parabon that is adopting a technology to look at almost a million places in your DNA, and not only be able to identify an individual but identify physical traits. So, as an example, we sent my DNA in and they then produced a profile of what the person would look like, necessarily, from that DNA and they got my eye color, they got my hair color --

>> **Gary Owen:** Wow.

>> **Dr. Brandt Cassidy:** -- basic characteristics of my face from that DNA. So, this is a tool that is being adopted as an investigative tool when you have a crime that happens and there are no witnesses. So now you don't know who to be looking for, and it seems to be in the United States anyway, it may be a very powerful tool to limit the number of people that you have to look at to identify who a suspect might be.

>> **Gary Owen:** So, this is under the term of "legal testing"?

>> **Dr. Brandt Cassidy:** That is correct.

>> **Gary Owen:** Okay.

>> **Dr. Brandt Cassidy:** We would work with crime labs and forensic evidence in those cases and we do some of that work. The other side of our work though is for relationship testing and we do just basic paternity testing. But we also do interesting things for reuniting families in adoption cases or in immigration cases where people are trying to bring family members from foreign countries over to live with them. And we need to identify them through their DNA match because the records in their countries are not sufficient to document who the parents are and things of that nature. So DNA is used to reunite those families from all over the world.

>> **Chad Mullen:** Well, Gary, you know, I think -- I've heard stories of my grandparents and great-grandparents that most of the records were the front page of the family Bible, so -- and I'm sure that's the case around the world as well, those vital statistics are kept that way. Tell us a little bit, Dr. Cassidy or Dr. Kupiec, how has the increase in the speed to be able to perform a DNA test, has that also led to the reduction of the cost and has that made it more widely-used now?

>> **Dr. Brandt Cassidy:** Yes, absolutely. When we first begin in 1998, just a regular DNA test was over $1,000.

>> **Gary Owen:** Wow.

>> **Dr. Brandt Cassidy:** And so it was limited in who was going to be able to afford that. And through the introduction of automation, we use some robotic systems in our systems now, and through the fact that we can process a lot more samples more quickly, the cost has come down considerably. So it would only cost hundreds of dollars now, just a few hundred, to get a relationship test done.

>> **Gary Owen:** And the accuracy is a lot more -- is better I guess, because of technology, right? More accurate testing being done?

>> **Dr. Brandt Cassidy:** Well, since we're looking at more places in the DNA from each individual, you have a much higher power of discrimination, so, that's where your accuracy -- I think that term is misused a bit in this area because we're 100% accurate. It's just if you don't have enough markers to compare, then your power of discrimination is going to be less, and you will --

>> **Gary Owen:** I see, okay. You know, let's talk about the public's perception about DNA testing, because, I mean, we're novice -- we don't know anything about it like you guys do in the lab so that there's myths and misunderstandings about how DNA testing and research is done and why it's done. And we -- you know, so there -- and who can actually order a DNA test. Talk about the protocol, if you will, for a minute because some people don't -- don't understand, well, what if I want to get a DNA test on a relative for some reason? Talk about that, how that works.

>> **Dr. Brandt Cassidy:** Well, it depends on the --

>> **Gary Owen:** The situation.

>> **Dr. Brandt Cassidy:** -- the question you're trying to answer and whether it's involved with law enforcement or not.

>> **Gary Owen:** But, I mean, John Doe can't just walk through the door and say, "Hey, I'd like to have a DNA test," they have to go through either a medical supervision or legal supervision. Am I correct, depending on the situation?

>> **Dr. Brandt Cassidy:** Well, there are some circumstances where individuals can provide information and DNA samples for testing.

>> **Gary Owen:** Okay.

>> **Dr. Brandt Cassidy:** On the animal side, it's interesting that especially now in the hunting season is starting up, it's not uncommon for us to get cases in which a hunter might shoot an animal and there's a blood trail but then they lose trace of it. And the neighbor in the farm next door finds a deer on his place and claims it as one of his that's dead on his farm, and the person who actually shot it can collect a sample from that dead deer and also from the blood on the trail that he followed and we can match it up. And so these ownership dispute kind of the things can be answered through that. And you don't have to go through any special form or anybody. If it's a cattle rustling case, then you would go through law enforcement and they would maintain a chain of custody and things of that nature.

>> **Gary Owen:** Any agricultural applications where a rancher might want to have testing done on -- for a particular reason on cattle through the sale process or through the breeding process? I mean, is that ever an issue?

>> **Dr. Brandt Cassidy:** Oh, absolutely.

>> **Gary Owen:** Okay.

>> **Dr. Brandt Cassidy:** Again, cattle rustling cases is one -- an area that we'd employ that, right.

>> **Gary Owen:** Right, which you just talked about. Right.

>> **Dr. Brandt Cassidy:** But then, they -- sometimes, it's not -- it can be an ownership dispute that somebody gets through the fence and the guy next door says no, that's his, and we don't have to go through law enforcement to do DNA testing.

>> **Gary Owen:** I was looking for more like the breeding process, if they're wanting to improve on breeding and so forth, like that. So, yeah.

>> **Dr. Thomas Kupiec:** Maybe looking at the traits. Traditional DNA --

>> **Gary Owen:** I'm going to have to stop you right there, we got to take a break. We'll come back. Don't -- keep that thought. We'll come back and when we return on *Oklahoma Innovations*.

[Music]

>> From Oklahoma City to Tulsa, Woodward to Lawton, this is your Science and Technology Radio magazine, *Oklahoma Innovations* on the OCAST Radio Network.

[Music]

>> Oklahoma is a leading energy producer with an economy closely tied to oil and gas. One in four jobs in the state are tied to energy.

>> Nitro-Lift Technologies of Oklahoma manufactures equipment for the oil and gas industry. With the support of the Oklahoma Manufacturing Alliance and OCAST, Nitro-Lift is developing new technologies that will enhance energy production, provide a safer work environment, and leave a smaller environmental footprint. With the development of new technologies, the company plans to double in size and triple sales in five years, adding jobs and improving

Oklahoma's economy. As one of OCAST's strategic partners, the Oklahoma Manufacturing Alliance works with manufacturers around the state to develop new products, streamline operations, and grow business. The Alliance is keeping manufacturing jobs in Oklahoma. For more information, call OCAST toll-free at 866-265-2215 or visit us on Facebook or our website at ocast.ok.gov.

>> As a police officer, one of the most dangerous parts of my job is arriving on a scene where an armed suspect has barricaded himself, or where we suspect some type of booby trap. We're most vulnerable when we don't know what kind of explosives or weapons are on the other side. It can be deadly.

>> Tactical Electronics, an Oklahoma-based company invents, manufactures, and sells tools such as under door cameras and video fiberscopes that are used by law enforcement officers, military, and counter terrorism personnel around the globe. The tools allow areas and packages to be inspected from a safe distance, which reduces the risk of injuries and death. With the support of OCAST, the company is developing image recognition software that scans packages and in milliseconds identifies what's inside. OCAST is advancing science and technology that not only improves but also saves lives. For more information, call OCAST toll free at 866-265-2215 or visit us on Facebook or our website at ocast.ok.gov.

>> Research and development, technology transfer and commercialization, creating high paying jobs in Oklahoma, it's what OCAST is all about. This is *Oklahoma Innovations* on the OCAST Radio Network.

[Music]

>> Gary Owen: Thank you for joining us on this week's edition of *Oklahoma Innovations*. This week, Chad and I are talking with a couple of doctors who are specializing in DNA research. Dr. Thomas Kupiec, who is CEO of ARL BioPharma, that stands for Analytical Research Laboratories, and Dr. Brandt Cassidy is the Laboratory Director for DNA Solutions which is the sister company of ARL.

>> Chad Mullen: Well, Gary, learning a lot of really neat information here, you know, I didn't realize that DNA testing was used so much in wildlife, so in deer and in some of the animals you mentioned, Dr. Cassidy, earlier in Africa. So, if you could, tell us a little about -- a little bit more about some of the improvements in wildlife.

>> Dr. Thomas Kupiec: One of the opportunities, as Dr. Cassidy was talking about earlier in a previous segment, was the traits and I -- to differentiate the traits from the identification. Traditionally, DNA -- just look at forensics, and by the way, we are moving more into the forensic market at DNA Solutions where it traditionally was animal and human traditional parentage relationship testing. The markets are -- there's some opportunities that we're exploring in the forensic arena. But typically, for instance, there would be in forensic arena, you would identify a suspect and then identity that individual and say, does their DNA match, getting an identity. And just like in a relationship, you can exclude or include, and looking at a relationship testing or an identity. An area that Dr. Cassidy mentioned in earlier, was talking about traits or that phenotype. So, based upon your genetic makeup, it would predict the eye color, just -- or the hair color, as he had mentioned earlier. Subsequently also, the individual that we sent that to did not know it came from him, so it was a blind sample. Leading into the animals, we also can look

at the traits. So if you're trying to achieve a desired trait in an animal species, then you can utilize DNA technology for that, and Dr. Cassidy may have several examples for that.

>> **Gary Owen:** Well, like an equestrian, I know that there at least used to be DNA for a breeding program was important, is that still the case?

>> **Dr. Brandt Cassidy:** Yes, absolutely. The pedigree of the animal is going to be the collection of all of the DNAs from his past. And as they continue to try and improve, they're going to identify the parts of the DNA that come from the sire and the dam or the mother and the father that, in part, particular type of physical traits, and so they can look at that and make selected breeding so that they can improve the genetics. And whether it's a racehorse or it's the amount of muscle on a cow, and the marbling characteristics that are controlled by the genetics, and so you can look at the DNA and identify those.

>> **Gary Owen:** You guys also do a lot of testing in the bacterial and fungal arena. Why don't you talk about why that's so important.

>> **Dr. Thomas Kupiec:** Right. This was a really good match-up with DNA Solutions and ARL in that Analytical Research Laboratory does a lot of testing for the drugs to make sure that they are sterile. And when a compounder or a pharmacy puts together a medication that's supposed to be sterile and it's sent to ARL and tested and comes back that it's not sterile, now there's something growing there, and we can identify that. So we can identify whether it's a normal environmental organism or it's something else, so that the facility that's manufacturing or producing that can take steps to correct it. So by identifying what it is we can tell them, and we can do work in environmental samples. We've worked with some drilling companies that are actually looking at the organisms that are involved in the corrosion in their pipe systems, or actually what's coming out of the well. Deep down there are certain microorganisms that are better at helping liquefy the oil, and so they'll actually put nutrients down and try and get those organisms going. And they want to make sure they got the right bugs down there. So we can identify those bacteria, as well.

>> **Gary Owen:** Well, and to show you the importance this, a recent issue came up, obviously, with the Bell Ice Cream plant. Talk about that. And were you guys involved in that, by the way?

>> **Dr. Thomas Kupiec:** We do a lot of specialty type work, and we're not allowed because of confidentiality, to discuss the cases that we're involved in.

>> **Gary Owen:** But I'm saying, do you do that type of testing?

>> **Dr. Thomas Kupiec:** Listeria and salmonella and E. coli are all things that we can identify.

>> **Gary Owen:** Yeah. Okay. All right.

>> **Chad Mullen:** Quick question for you, Dr. Cassidy, on the -- with the well, there's -- is there a way -- would there be a way at some point, with some of the new testing you're doing, to tell if oil came from a certain area or another? Is that a possibility based on these microorganisms in it?

>> **Dr. Brandt Cassidy:** Maybe not based on the microorganisms. You can certainly study the oils themselves and they'll tell you which reservoir it would have come from.

>> **Chad Mullen:** Very interesting. Switching gears a little bit, we've brushed on it, but certainly everyone talks about CIS effect, and everyone wants a DNA test, and, Dr. Kupiec, you talked a minute ago about how you've moved beyond just, you know, identifying one individual

versus excluding folks. But during the break you were talking about some of the other types of testing you were doing to determine if something was an accidental death versus --

>> **Dr. Thomas Kupiec:** A society -- exactly. We had an interesting this past summer, it was a perfect storm. And [inaudible] individual we were contacted and believed that the death was due to a suicide. In reality, it was utilizing pharmacogenomics. And pharmacogenomics is a term for personalized medicine. Essentially each individual genetics' makeup will dictate how they metabolize a particular drug. They can either be a slow or a fast metabolizer. They can also predict susceptibility. Just as we do with, you know, from diagnostics, you can look at your response to drug, or the -- and it's not just the --

>> **Gary Owen:** That's okay.

>> **Dr. Thomas Kupiec:** Okay. So the idea is, we were contacted and they believed it to be a suicide. We tested the medication first, because [inaudible] to say, well, if there's -- the levels in the blood was found to be in the toxic or fatal area. So the concentration of that particular drug was in the -- was at a fatal level. It was believed that this individual had committed suicide, and in reality the -- when we tested the medication they were the correct strength. Initially we thought maybe there was a concentration problem with the tablets or capsules. Then subsequently we were able to capture some of the blood from the medical examiner's office, test the blood, DNA Solutions extracted the blood, purified, and then we sent the DNA for next generation sequencing, and we did a full panel of the medication. It came back -- I mean, a full panel of the genetic profile. It came back and showing that this individual was an intermediate metabolizer. Meaning that you are altered or it slows the rate at you -- at which you eliminate the drug out of your body. So here an individual was prescribed a medication that they were eliminating it at a slower rate, resulting in a toxic level. What added to this were two other factors. This individual was prescribed by his physician at a high level due to he was an autistic young man, and so this medication, the physician had prescribed a high level, not knowing the patient was a slow metabolizer. So he was giving an additional level with it. And then what even compounded this problem further was another drug. And so what you had was two drugs, so you ended up with a drug/drug interaction --

>> **Gary Owen:** Wow.

>> **Dr. Thomas Kupiec:** -- a high level, plus an individual who was a slow metabolizer, so the buildup of this drug resulted also in his death. That's an example of the pharmacogenomics that can be utilized to solve many different areas.

>> **Gary Owen:** And as Dr. Kupiec is describing, you can tell, some cases can be very, very complicated. And on radio, unfortunately sometimes it's a little difficult to explain that, and you've done a great job, so I commend you for that. But -- because we -- Chad and I, we don't know how you guys do this anyway. I mean, just to read the results to me would be mind-blowing, so --

>> **Dr. Thomas Kupiec:** It's interesting that you say that, because it's not -- you know, many people can test, but it's the interpretation --

>> **Gary Owen:** Exactly.

>> **Dr. Thomas Kupiec:** -- and I think that -- you're right on, Gary, that is the interpretation of the results.

>> **Gary Owen:** Right.

>> **Dr. Thomas Kupiec:** I am amazed all the time the work that Dr. Cassidy and Dr. Anstead [assumed spelling] does at our DNA company, because a lot of data come through there, but the interpretation, how you interpret it, how do you problem -- it's like a puzzle and you're putting together that solution and finding that solution for that puzzle. [Inaudible] they operate many different types of, and solve many different puzzles, whether it be human, animal, or bacteria or plant.

>> **Gary Owen:** And in the lab, you know, we see on television, of course Hollywood tends to blow things out of proportion a little bit for visual entertainment, but you see those in the labs, like on an NCIS, for example, or any of these TV shows and they run the -- they to run the matches through and then you see the computer go, match, match, match. I mean, does it work that way in the lab?

>> **Dr. Thomas Kupiec:** No, our program doesn't [inaudible].

>> **Gary Owen:** That's what I thought.

>> **Dr. Thomas Kupiec:** And --

>> **Gary Owen:** I just want to clarify.

>> **Dr. Thomas Kupiec:** It does take more than an hour --

>> **Gary Owen:** Yeah. I just want to clarify.

>> **Dr. Thomas Kupiec:** -- for some of that stuff. So, yeah, the CSI is a real effect, and we deal with that, and explain to people the reality.

>> **Gary Owen:** Sure.

>> **Dr. Thomas Kupiec:** And once they understand it, they feel a lot better about it. And we don't always get results. I mean, some of the DNA can be degraded by the environment.

>> **Gary Owen:** Right.

>> **Dr. Thomas Kupiec:** So if it's left in the sun or bacteria or fungi are growing on it, they will degrade the DNA to a point where it's not usable anymore. And so sometimes we just don't get results and that's unfortunate.

>> **Chad Mullen:** And I assume that a lot of the DNA analysis that you perform, it's based on probabilities. And I think we all have a difficult time understanding probability. If there's a 70% chance it's going to rain, we think it's going to rain [inaudible] and we'll follow up more on that [inaudible] in a minute here.

>> **Gary Owen:** Yeah, we've got another segment. And I want to know where the company's vision is for the future and talk about some of the employees that you have working for you, because it's a fascinating company. Back with more on *Oklahoma Innovations*.

[Music]

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[Music]

>> **Gary Owen:** Dr. Thomas Kupiec and Dr. Brandt Cassidy are our guests this week on *Oklahoma Innovations,* talking primarily about what their labs do in terms of DNA testing and research.

>> **Chad Mullen:** Yeah. Just absolutely fascinating stuff. I'm learning a lot today. It's really amazing all the fields that DNA testing can be used in, and, you know, especially on the forensic side. And I didn't realize, it's always good to hear that this is going on right here in Oklahoma, right here in Oklahoma City, and it's -- it's customers around the world. But, you know, switching gears a little bit, Dr. Kupiec mentioned earlier that -- that he owes his success to his talented team, and all the folks that made him successful. And tell us a little bit about some of the future students that are -- the next generation of talent that's coming through your company.

>> **Dr. Thomas Kupiec:** Well, you know, I expect our companies -- we would have never -- starting out 15, well, 17 years ago, I would have never believed it would be where it is today. And as I said earlier, it is the people, it's truly divine intervention. I think it's -- as I credit God for all the success. But I do think that we -- I expect us to double, again, in five to 10 years. You were asking that during the break. I mean, we've grown significantly and continue to do that. We've averaged double-digit growth since the beginning.

>> **Gary Owen:** And tell us a little bit how you're going to develop that workforce.

>> **Dr. Thomas Kupiec:** Well, that's an issue. I mean, it's always -- you know, it's interesting, you mentioned workforce. We attract a fair amount of people from the East Coast and West Coast. I mean, the young gentleman that runs our -- well, works for Dr. Cassidy, Dr. Anstead, his wife is a [inaudible] issue, and so we attract talent. The gentleman that runs our laboratories at ARL, he came from Pfizer, worked there for 10 years.

>> **Gary Owen:** Wow.

>> **Dr. Thomas Kupiec:** We have a gentleman, Dr. Liu [assumed spelling], who runs our R&D department at ARL, and his wife is a professor at the College of Pharmacy. So we are talking about collaboration. At the beginning of the show, it's a nice way -- as we were talking [inaudible] segment, in that we have a lot of internships and students will do a rotation through there. And both ARL and DNA has utilized, for many -- not just local, OU or OSU or UCO, Cameron, the community college, we like internships. And it gives the student an opportunity to operate in a real life situation and see -- explore, do they want to pursue this. And it gives the employer an opportunity to evaluate, is this some potential talent that we want to retain for the future.

>> **Gary Owen:** Sure. Absolutely. Dr. Cassidy, where do you see the future of DNA research and testing going into fields that we're not in now?

>> **Dr. Brandt Cassidy:** Well, we're, as I said at the beginning, continually adopting the innovative technologies that are coming out. And certainly the application of whole genome sequencing is going to be an area that there will be a lot more push to get into. So we'll be able to do a lot more identification and many more things with that much more information, when you're looking at a whole genome versus just bits and pieces of it. We're also looking to bring in people who are coming through the system. The programs at the Forensic Science Institute in UCO, we have the interns from there that come through, and it's not uncommon for us to hire them, actually, once they're completed with their degrees, as we continue to grow. Because, as Dr. Kupiec says, we're looking to hopefully double again in the next five years, so we will need that workforce. We also work with the Biotechnology program at OCCC, and they produce some really talented people who are trained specifically in the areas of biotechnology. And that is the area where we find most of our people, so that's really good.

>> **Gary Owen:** Yeah, it sounds like biotechnology is going to be big business, and already is somewhat big business in Oklahoma now, isn't it?

>> **Dr. Brandt Cassidy:** Oh, absolutely. And that's the nice thing about this district is that we do collaborate with other companies that are within this area. There are manufacturers who are producing biological drugs. And one of the last steps that they have to do is demonstrate that once they purify this new drug, that there's no leftover material from the organisms that produced it in the beginning, it's called residual DNA testing. And so we work with companies to identify what -- the amount of residual DNA is in their final product.

>> **Gary Owen:** Did I hear, we were going to the break a while ago, somebody talking about relationships, the research in bone DNA, was that -- was I hearing that --

>> **Dr. Thomas Kupiec:** Yes, we actually -- Dr. Cassidy has quite been an experience and a success in extracting DNA out of the old bones of animals. And it's interesting, we've had an opportunity present itself this past year at looking at veterans and bones. So we're looking at veterans that have -- are fallen soldiers and reuniting them with their families. So I think [inaudible] first samples that we received, and so we're looking at moving into that market of testing the bones of these fallen soldiers and then bringing -- and reuniting them with their families.

>> **Chad Mullen:** Oh, that's fantastic. So what we're talking about here are remains that are found either overseas, I imagine, in most cases --

>> **Dr. Thomas Kupiec:** Yes.

>> **Chad Mullen:** -- and then identifying that person. That's --

>> **Dr. Thomas Kupiec:** And Dr. Cassidy hit the nail on the head when he was talking about many times [inaudible] degraded. But we want to utilize the technologies that's available to us, whether it be traditional [inaudible] or mitochondrial DNA, or various techniques to capture -- to try to do the best to reunite these families with their fallen soldier.

>> **Chad Mullen:** Well, and I'm -- just I'm curious here, really peaks my curiosity. How are you identifying the person? Are there old DNA samples that you're comparing against, or is it more

the process of determining what this -- the traits of this individual and them matching up, or how does that work?

>> **Dr. Brandt Cassidy:** Right. It's through relationship analysis, actually. So if you have DNA from an individual and you have their siblings, you can compare the DNA and identify the, as you said, the probability that they are true siblings, or they're grandparents or parents. You can get a little further out. You can get sometimes to nieces and nephews, and eventually if you have enough information, you can go to cousins.

>> **Chad Mullen:** Wow.

>> **Dr. Brandt Cassidy:** So you can do all of that. There are certain characteristics, like the Y chromosome is passed on from male to male, in a line. And if you have male relatives within a line and you need to know the family pedigree, obviously, then you can do a Y chromosome test, and you can get all the way back to great-grandparents or you can get further in male lineage that way. You can do the same thing with the mitochondrial DNA, that Dr. Kupiec mentioned, on the mother's side, because your mitochondrial DNA is passed from mother to child. And so if you have a female lineage and then you have your mitochondria, you can determine whether you're in that same lineage or not.

>> **Gary Owen:** Ladies and gentlemen, there will be a test next week, just do your homework. The science behind DNA testing, what courses you have to take and how you come to become a Dr. Cassidy. How long does it take you to get where you are as far as getting -- actually getting into DNA testing?

>> **Dr. Thomas Kupiec:** Well, I --

>> **Gary Owen:** [Inaudible] and --

>> **Dr. Brandt Cassidy:** Right. I mean, having a bachelors and then getting a PhD takes an extra seven years of schoolwork and --

>> **Gary Owen:** Wow.

>> **Dr. Brandt Cassidy:** -- studying genetics and then learning all of the techniques to extract DNA and tease out all the information that might be available there. That's more practical experience, and I have 18 years in the laboratory doing that.

>> **Gary Owen:** Computer technology is always changing, getting faster and having more memory storage on short, you know, chips, and hard drives, how is that affecting what you do, and how do you keep up with it?

>> **Dr. Brandt Cassidy:** Well, we're actually thankful for the new power and the programs that are available to help analyze all of the information. When you're working with just a few DNA markers, it's not difficult, but as you increase the number, then you need to have powerful computers and programs in place. The bioinformatics is a much up and growing area that I can see will be really important in the future to be able to deal with all of this huge datasets and be able to do the analysis that's required.

>> **Gary Owen:** That's amazing. Let's talk a little bit about where forensic science is going in the terms of DNA testing. I mean, it's gotten so refined, and you -- I know, Dr. Kupiec, you have been involved in law enforcement for a long time, and toxicology, and you've been a witness in

jury cases, both on the local, state and federal level. Where do you see this science going for crime investigations?

>> **Dr. Thomas Kupiec:** Well, I think it's like Dr. Cassidy mentioned earlier, well, there's a term next generation, we were talking about the next segment, next generation, next generation sequencing. And as you're looking at just a few markers initially for identity, and even now we've continued to expand the number of markers, and wanting to use -- utilize the latest technology for identification purposes to increase that probability numbers. I think by having a full sequence or a full next generation sequencing, that gives you more data points. I do want to add one additional comment. We were talking about education, for instance what Dr. Cassidy had. One expects you to have the employees -- the individual to have the knowledge and skills, but from our perspective in leadership, we want to look for talent, as well. So I think many people, you expect the scientist to have the basic knowledge and skill, but I think that success and the sustainable scalable success would require talent. And I think that's an important factor, also.

>> **Gary Owen:** Dr. Kupiec, Dr. Cassidy, thank you so much for being our guest this week, and Chad and I will have to get on the DNA Solutions website and the ARL website and do a little more homework, [inaudible] pass that on. If you're interested in learning more about what these organizations do, we encourage you to get on their websites and learn about them. Just search in DNA Solutions or ARL or actually what we call the Analytical Research Laboratories, that's a mouthful. Chad, hope you learned a lot.

>> **Chad Mullen:** Absolutely, Gary, a lot of good information.

>> **Gary Owen:** All right, we'll talk to you next time on another edition of *Oklahoma Innovations*. Have a great week.

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