

Oklahoma Innovations Radio Show

Air Date: January 16-17, 2016

Guests: **Anne Pereira**, University of Oklahoma Health Services Center

>> 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 Chad Mullen.

[Music]

>> **Gary Owen:** Welcome to this edition of *Oklahoma Innovations*. We're delighted that you're with us and this week we have a really interesting guest from the OU Health Sciences Center. Chad, why don't you tell us about her?

>> **Chad Mullen:** Gary, I'm excited to have with us and introduce Dr. Anne Pereira. Dr. Pereira is a researcher and academician, a dean, a business owner and really a mentor to a lot of students at the college from OU Health Science Center at the School of Pharmaceutical Sciences; is that correct?

>> **Anne Pereira:** That's correct.

>> **Chad Mullen:** I sometimes forget all the names of the different schools over there, but Dr. Pereira has really been a leader both in research and mentoring the next generation of researchers as well and we're very excited to have her on the show today.

>> **Gary Owen:** And the cool thing is she has been named a 2016 National Academy of Inventor's Fellow. That's a high professional distinction award to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on the quality of life, economic development and the welfare of society. That's pretty impressive.

>> **Anne Pereira:** Thank you.

>> **Gary Owen:** But you've got an impressive background. We want to learn about that. So you've been at the OU Health Sciences Center as a faculty member for the past 23 or 24 years? Tell us about that.

>> **Anne Pereira:** That's correct. I came to the University of Oklahoma Health Services Center in 1992. I had just finished a post-doctoral fellowship at Emory University in Atlanta having done my PhD at the University of Melbourne in Australia. My PhD was in pathology.

>> **Gary Owen:** Wow.

>> **Anne Pereira:** And then I spent a number of years at Emory in Atlanta and was very fortunate actually to move to the Health Sciences Center and it's really been a fabulous

springboard for my research, my interaction with students and the ability to continue with my inventions that started whilst I was at Emory.

>> **Gary Owen:** Let's talk about your patents because during your research career you've obviously been awarded with a lot of patents. Fourteen in the US; is that right?

>> **Anne Pereira:** Fourteen to date, yes.

>> **Gary Owen:** And you have 4 foreign patents.

>> **Anne Pereira:** That's correct.

>> **Gary Owen:** And any pending?

>> **Anne Pereira:** Yes, quite a few pending actually at the moment, and it all really started while I was at Emory. We were in a very competitive area of research and my mentor an amazing guy, John Spitsnogle [phonetic] indicated to me that even though I was having trouble getting one of my manuscripts published because of the competition with these other groups around the country the way someone would know that I was the first who actually sort of found this protein, CAP 37, was to actually file a patent and so that's how I got into the patent game and that was back in 1989 when we filled the first patent. And so it's sort of contagious. Once one gets into that little mode of invention and patent filing --

>> **Gary Owen:** -- and then you learn the ropes pretty quick don't you?

>> **Anne Pereira:** You learn the ropes, yes. And it's very fortunate when I moved over here at the health sciences that they were willing to support my entrepreneurial activities. It was at a time early 90s so not many universities, it was a fairly, I would, I guess a different for academics to be involved in entrepreneurial activities and supporting patterns and all of those activities was just very new whereas the Health Sciences Center really bought into that very early in the game and so it was fortunate, serendipity that I ended you here.

>> **Chad Mullen:** And, Dr. Pereira, tell us a little bit about for our listeners at home kind of some of the changes that you have seen and just what you talked about the ability for a professor or researcher to pursue entrepreneurial activities over the past, you know, 20 years or so because I believe that's changed quite a bit; is that correct?

>> **Anne Pereira:** It really has, you know, there are very few universities that even had offices of technology development and now pretty much find that in most universities academic centers. It is supported. I think people realize that the commercial development is really of value not just for the university and the inventor but actually for society and welfare.

>> **Gary Owen:** Yes.

>> **Anne Pereira:** So it really does have a lot of benefits especially for someone who is in the pharmaceutical developing drug discovery unless you have a patent there are very few pharmaceutical companies who would be willing to develop that as a drug and as you know drug development is a big cost of the business. It takes many years. So unless you have the intellectual property some of the best ideas might actually fall by the wayside. And so that seems like a very appropriate way to educate our students, graduate students in science, technology, entrepreneurial activities. It just seems to be the wave of the future if we can actually sort of start these within universities with our graduate students and educate them in the way of

biotechnology, biomedical research, you know, things that probably were not part of their curriculum 20 years ago.

>> **Gary Owen:** Talk a little bit if you will about the school because the training these students are getting will help them diversify or branch off into whether it's academia, whether it's into bioscience research, pharmaceuticals, I mean it's a pretty broad range isn't it?

>> **Anne Pereira:** It really is. And I was very fortunate in 2014 I was offered the position of the graduate college dean at the Health Sciences Center and there I realized that there was just so many students, graduate students, in so many different disciplines, allied health, nursing, pharmacy, dentistry, medicine, public health, and these are all the different facets that affected us in society. Having the smarter disciplinary, interdisciplinary education students interacting with each other trying to get broad-based curriculum, trying to not pigeon hole our students into any one career and that, too, has changed over the years. Previously it was very much to clone our own students in the way of becoming academics, becoming tenure track professors and moving up the academic tree, but a lot of our students these days really want different careers and they are looking at things in policy, public health, they are looking at areas of becoming scientific writers, relaying information to lay persons. We might have people who go into consulting and then we have people who might want to start their own businesses. So it's a wide array and we're trying to educate and open career opportunities for all students who would wish to pursue all of these diverse areas that a PhD or a master of science would allow them to pursue.

>> **Gary Owen:** And the school has, I know Chad commented about this at one point of the attraction of international students. I know you have followed up on a lot of this.

>> **Chad Mullen:** Yeah, I mean absolutely. I think many of the universities in Oklahoma and OUSHC is no exception has really brought some great talent from around the world; is that correct?

>> **Gary Owen:** And that's true. We do have a number of international students. These are students who are obviously at the very top in their own countries. They might be here on Fulbright scholarships. We have students who come from Europe from the Middle East, from Asia, Central/Latin America. So there's a wide array of cultures, diversity. This really all adds to it because research and science and education such a global thing, and I think we all really benefit by having the input from these various students and it's not just the graduate students. I think our biggest foreign contingency is at the post-doctoral level. So we have a number of countries that don't have a post-doctoral I guess culture that pays post documents whereas we do in the States. They don't have, we are very fortunate to have national post doc association --

>> **Chad Mullen:** -- and explain what a post doc is.

>> **Anne Pereira:** Okay. And so a post doc is someone who has actually finished a PhD. So you have pretty done your undergraduate, 6 years of graduate work and then it's another maybe 3 years, 4 years, sometimes maybe even 6 years of training period where you've been taught to be somewhat independent and this is really when you're most creative, you know, you're kind of in that late 20s, early 30s, ideas are just buzzing through your brain. You're energetic, you've got the ability and you're just competitive. I mean that really is a group of people who bring out the best inventions, the best creativity. They help senior, principle investigators write their grants, write their manuscripts and some of the best manuscripts really come out with post docs being the primary author. So that really is a group of talented people that we really need to tap into and

we see a lot of foreign post docs who come in because I think in Europe and in the States we probably have some of the best training at that level.

>> **Gary Owen:** OU Health Sciences Center they focus on a variety of research, cancer, diabetes, immunology and infectious diseases, which is in your area. Neural sciences and vision.

>> **Anne Pereira:** That's right. Those are some of the foci [phonetic], focuses, of the university and the research missions. We have a lot of philanthropic funding in those areas and that naturally supports those. Of course, there are other areas that we are well known for and some of that areas is in aging. We have a number of scientists who are working in that area. We have others who are working in structural biology and so it's at different levels. We have a number of very good basic scientists, which I think is where a lot of the inventions and the ideas come from. And then we have the more translational scientists who have taken some of their research from the bench and now looking to actually getting this out into the clinic. But an area that the NIH and some of the federal agencies are focusing on right now is we really need to take it out to society and so these are a group of faculty, physicians, clinicians, pharmacists, nurses of all of the areas that we focus on that actually take findings or outcomes to their clinical practice and that's another area that we really would like to focus on because I think that's really where you need to see the outcomes and the measures. These could be things in education, they could be looking at big databases. You can actually look at information, excuse me, with regard to medical compliance, costs, health economics, a lot of areas that are just not bench science areas that are very valuable.

>> **Gary Owen:** I tell you what we have a lot to learn. We're going to take a break here in just a moment because I want our listeners to learn more about your research with CAP 37 and educate them about what that protein is and why it's so important. Your research has been so important to fight infectious diseases, and I think when you hear what she has to say it's going to raise your eyebrows and go wow because she's doing some really cool research and she's got some nice patents in the wings too to help support all of that. We'll return with our guest Dr. Anne Pereira when we return on *Oklahoma Innovations*.

[Music]

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>> **Gary Owen:** Our guest this week on *Oklahoma Innovations* is Dr. Anne Pereira, appointed dean of the OU Health Sciences Center Graduate College back in 2014. This is an educational

center for training some of the world-class biomedical researchers, and I tell you quite a broad base as we mentioned in the first part of the segment.

>> **Chad Mullen:** Absolutely. OUHSC and, of course, OSUCHS as well are both --

>> **Gary Owen:** -- that can be confusing.

>> **Chad Mullen:** It can be confusing so our great centers we have here in Oklahoma. Dr. Pereira, one thing I want to pick up on is something you mentioned in the first segment and you talked about the importance of working with the post doc students that you work with and other peers. Being able to speak about your research frankly in terms Gary and I can understand, you know, plain English so to speak. Tell us a little bit about that and why you feel so that's important and why you're passionate about that.

>> **Anne Pereira:** Okay, so I think communication is one of the greatest strengths we can have. A lot of people are unable to convey their research that they do, what they're involved in, and it's very important especially if one is funded through the National Institutes of Health or other federal agencies, it is really taxpayer money that's supporting your research. And so one really needs to be able to communicate to people who might not be involved directly in science or technology how important this area is and the relevance that it has to their lives, their families and with regard to society. And so we start very early we've got different levels of communication. We have students who need to write scientific writing to be able to convey their findings at a scientific level that we relay to the peers, but then it's also very important that when they talk to family members or to politicians, to people who might be able to support their research this is really critical and very many students and post docs and even faculty have a difficulty in actually --

>> **Gary Owen:** -- because it's the language that you're involved with. I mean medical technology, science technology it's, it's a foreign language.

>> **Anne Pereira:** It is.

>> **Gary Owen:** And to convey the science to the public that's tough sometimes I think.

>> **Anne Pereira:** That's right. We tend to resort to jargon so much that it really becomes, you don't want to build up barriers between yourself and the general public. And so I feel that this is very important that students get taught this as early as possible. We have a symposium every year at the Health Sciences Center where students present their work. This is open to people with different disciplines and so they have to be able to relay their findings that would make sense, make an impact where people sort of go, wow, that was really neat. And so, yes, so I think communication is really one of the very important aspects of science.

>> **Gary Owen:** You know and another challenge that we haven't talked about here, Chad, when you talk about language is when you talk about international students who have to convert that information into their language and their culture to help those countries understand what they're studying or what their sciences are that's got to be a tremendous challenge for a lot of graduate students.

>> **Anne Pereira:** I really admire foreign students when they come in and not so much as when it comes to writing but in actual conversation.

>> **Gary Owen:** Exactly, yeah.

>> **Anne Pereira:** Becomes the to and fro, you know, the actual discussion, being able to respond to questions, that it's amazing to see them develop over the years and they get a lot of help from their peers and other students. It's very nice to see them working in study groups helping each other, being supportive and, you know, by the time they are finished with their PhD they are some of our best students.

>> **Gary Owen:** Wow.

>> **Anne Pereira:** So that's very, very encouraging.

>> **Chad Mullen:** And it's good to hear this because we certainly and I certainly hear quite a big area the discussion about, you know, our professors at universities are just doing research and not doing anything productive, they're not teaching, you know, we're just kind of wasting money. And I think that there's, Dr. Pereira is absolutely right that probably all of us involved in this area need to do a better job of explaining what are the outcomes of the research? Why is it important to undertake it? And experiment or an investigation doesn't yield a result that's still a positive thing because that allows you to move on to the next hypothesis I suppose or the next project. And so it's always, you know, I really admire what Dr. Pereira advocates for over at the university and to do that so I think you do a great job with that.

>> **Gary Owen:** I've got to, not to interrupt you here, but let's talk about OCAST for a moment because when you have applications come in for seed funding, which has been happening since 1987, right? So you think about all these projects that come through the door, the peer review boards who have to review these papers and their interpretations I mean how do they read all of this to understand it?

>> **Chad Mullen:** We're fortunate that our peer reviewers are as smart as Dr. Pereira and far smarter than I am.

>> **Gary Owen:** They get it.

>> **Chad Mullen:** They get it, they don't have to do it. One of the things that we've always asked our applicants to do is provide an abstract in fairly simple terms that is publishable and that really helps folks like me convey the intent of that research. I can tell you that some of those abstracts are a little more understandable than others. Some of them are fairly jargon laden, but we can go through and look at the research aims and goals and kind of come up with the importance of that research, but yeah, you're absolutely right, Gary, it's very important to really tell that message and, you know, one of the things that we've seen recently was a video that went viral of the shrimp on a treadmill and I think we've all seen it. It was an NIH project. The project was not to make a treadmill for shrimps. It was actually a very different project and the researcher made like a \$20 treadmill in his lab and saved tremendous amount of money by doing this, but because of that narrative wasn't told in the right way it really created an issue.

>> **Gary Owen:** That's too bad. Well, as I promised we were going to try to do it in this segment but I think we'll be better off in the next segment because Dr. Pereira has quite a bit of financial support into some of her research that she's done on a protein called CAP 37 and it's probably going to take her a little bit of time to convey that. We're going to put that challenge on you now to convey your research to us lay people, okay? So we're going to take a little break and we'll come back and talk with Dr. Anne Pereira when we come back at *Oklahoma Innovations*.

[Music]

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>> **Gary Owen:** In the last 10 years, antibiotic resistant infections have risen around the world and new therapeutic strategies for treating antibiotic resistant infections are urgently needed. Company founded by our guest, Dr. Anne Pereira, who is dean of the OU Health Sciences Center Graduate College, founded a company called Biolytx Pharmaceutical Corporation. And she currently serves as Chief Scientific Officer. Anne has done quite a bit of research on a protein called CAP 37 and she's been awarded millions of dollars in grants over the last few years, and we're going to find out just exactly what that research is and what it means to us as lay people. So the mic is yours.

>> **Anne Pereira:** Thank you. I don't know whether we have enough time for me to go through all of this. You've got me on my soapbox. [Laughter] Thank you. Well, my research on this

started like you said about 25 years ago when I was a post doc at Emory and that was a time when antibiotic resistance was rearing its ugly head. And infectious disease docs were getting very alarmed that we were running out of antibiotics. We had sort of been in a wonderful state where we always were a jump ahead of these microorganisms, but then it becomes fairly apparent that the antibiotics we were producing were just not being sufficiently effective against bacteria for very long. And these are what we call these antibiotic resistant bacteria alternatively called super bugs. You might have heard of those.

>> **Gary Owen:** Super bugs, yeah.

>> **Anne Pereira:** And so the issue it's really fairly complex issue as to why organisms are so resistant to antibiotics, why they gain resistance so rapidly, and I think one of the biggest issues here has been that really the production of antibiotics has not kept abreast of this antimicrobial resistant organisms. A lot of the drug companies have pulled out of this area because making an antibiotic is something that is probably not as lucrative as making a drug that you would use for cancer or cardiovascular disease or a chronic disease like diabetes where you would have the person on this drug for the rest of their life. Antibiotics are generally a 7-day, 9-day treatment --

>> **Gary Owen:** -- short term, yeah.

>> **Anne Pereira:** Short term. And they cost very much less and so a lot of the big companies pulled out of this area leaving biotech companies and academic scientists sort of looking at this area. Just go give you some idea only 2 new classes of antibiotics have been developed and approved by the FDA since 1998.

>> **Gary Owen:** Wow.

>> **Anne Pereira:** So what has really been happening over the last few years is old drugs have been tweaked and changed and, you know, but it's still an old drug, it's not really a new drug. And so organisms, pathogens, bacterial, whatever you want to call them, see these and they've seen them previously and so the changes of them becoming resistant to these so called new antibiotics is the chances are pretty high. The other issues that come into it have been probably the over use or the misuse of antibiotics.

>> **Gary Owen:** I was going to ask you that question, yeah.

>> **Anne Pereira:** You know it's not just people but a lot of the antibiotics that are produced these days are actually used for livestock, animal feed, it's used as a preventative trying to keep animals that are in close quarters from getting infections, but also as sort of like a growth medium. Animals on antibiotics seem to grow much quicker, much faster and so you can get them to market much quicker. So, there again a lot of the antibiotics are at this low level of being introduced into the food chain and these are the same antibiotics that are also being used on humans. And so that's also being compounding that the whole problem.

>> **Gary Owen:** So are we -- not to interrupt you -- am I hearing you say that all of a sudden we as living beings animal or human we've kind of adjusted and have kind of become immune to the antibiotics?

>> **Anne Pereira:** So, you know, we're not sure of the mechanism but it appears to be that if you keep getting this low dose of antibiotic within your food and so on, that there are chances that what it's doing is maybe the organisms that are sensitive to this antibiotic die off rapidly leaving the ones, [inaudible] are the ones that you know to develop and grow. So really the problem has

reached such a global issue that the president, President Obama called together his I believe it's his Council of Advisors on Science and Technology, in 2013, and made them look at this whole antibiotic resistant crisis because it's very much a global issue.

>> **Gary Owen:** Yes, it is.

>> **Anne Pereira:** And asked them to come up with some sort of action items that could easily be implemented or would be readily implemented and they came up with 3 main goals for this global health issue. One was increased surveillance so we could actually document the kinds of infections, take action quickly, determine what kind of infections were coming up, then trying to increase the longevity of currently available antibiotics and you might be able to do that by using combination therapies in an area similar to what was used with AIDS where these combination therapies became very valuable and the other was to come you with new antibiotics and new, when I mean new, I mean not just a tweaking of an old antibiotic with a definite differently class of antibiotic. And so scientists are looking at areas like marine organisms, plants, our group in studying at Emory was actually decided that we should actually look at the human body because the human body fights organisms and so the idea was could we actually extract a protein from the cells that do all the fighting or the bacterial, anti-bacterial activity identify a naturally occurring protein and then develop this as a therapeutic and that's where they come full circle there, a long way to come around to tell you what CAP 37 was.

>> **Gary Owen:** Interesting.

>> **Anne Pereira:** But it's a protein that's actually an anti-bacterial protein that's present in humans and we were able to isolate it, show that it was active and the most innovative part of the whole study over the years has been to identify small areas of this protein called peptides, and we can make those peptides in the lab and these peptides actually can kill microbial organisms that are resistant to various well-known antibiotics. The activity is mainly on a group of organisms known as gram negatives. And so it's a very sort of specific activity. These organisms, salmonella that you might have heard of, you know, Turkey, E.coli that you might hear of is another sort of, pseudomonas aeruginosa, which you probably may not have heard of, but is very common in hospital acquired infections, people who are more on ventilators and so on. Very serious. And then another group of organisms known as Acinetobacter baumannii [phonetic]. This is an organism that really wasn't known until the late 1990s, early 2000 when we started isolating them in soldiers who came back from Iraq and the resistance to this, these organisms resistant to current antibiotics is just tremendous. And so really they have had to resort to antibiotics that were taken off the market way back in the 1960s because of all of the toxicity associated but that was like the last line of antibiotics that was available. So it really is a very, very serious issue and trying to find funding to support all of this research and to come up with new antibiotics to keep ahead because it really seems really unthinkable that you might actually die of an infection that either a doctor is unable to provide an antibiotic. We also think that there's always going to be an antibiotic available.

>> **Gary Owen:** Yeah.

>> **Anne Pereira:** But it's almost come to that position now where the antibiotics, the effective antibiotics are really dwindling.

>> **Gary Owen:** I think people are pretty alert at about the hospital, particularly the ones we hear about a lot or that's one of their biggest fears about having surgeries or any kind of hospital care

is, gosh, I hope I don't get this, you know, and I know hospitals do a great job of trying to sterilize, quarantine, but sometimes it's still not enough.

>> **Anne Pereira:** That's right, yes. And most of the hospital acquired infections tend to be so serious because the patient is in most cases seriously ill to start off with.

>> **Gary Owen:** Right, exactly, or their immune system is low.

>> **Anne Pereira:** It's low, exactly. So, and most of those organisms you've heard of the clostridium difficile which is a big issue.

>> **Gary Owen:** C.diff.

>> **Anne Pereira:** The C.diff as it's called, yes. So, yeah, the MRSA, which is more of a community acquired, but yes, there's lots of different organisms out there that multi-drug resistant and that I think is really the, it's not just one antibiotic but they're resistant to numerous antibiotics.

>> **Gary Owen:** But you know I know just our regular physicians struggle sometimes with just influenza or viruses that usually are treatable by antibiotics and sometimes it takes some pretty more than one regimen to try to get the patient well because the first regimen didn't work and so the second time let's try a more powerful antibiotic and sometimes that does or doesn't work. We just don't know. We do now want to shift gears here after the break and talk about what Biolytx' mission is, where they're going with your research, what kind of clinical trials may be on tap. So we're going to talk all about that when we return on *Oklahoma Innovations*.

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[Music]

>> 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.

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[Music]

>> **Gary Owen:** Welcome back to *Oklahoma Innovations*. We certainly hope that you're gaining a lot of new knowledge of what it takes to really down home get into the meat of developing new pharmaceuticals to help we humans and animals stay well, and we've also learned a lot about the OSH, the OU Health Science -- I almost did it -- OU Health Sciences Center Graduate College. And our guest, Dr. Anne Pereira, who is the dean of the college and

she's also, she's an entrepreneur, she's an innovator, she's a researcher, and I don't know when you have time to enjoy life on your own.

>> **Chad Mullen:** And, Gary, you know we were talking between the break and it's interesting about the misuse and overuse of antibiotics. I grew up in an era where you went to the doctor for anything and he or she would prescribe antibiotics for anything including viral infections which I believe if I'm correctly stating the antibiotics do not have any impact what so ever.

>> **Gary Owen:** It's on infections not viruses.

>> **Chad Mullen:** And I remember a time where, you know, my mother would call the doctor and say, yeah, you know, my office mate has the flu call me in a prescription of an antibiotics and I would do it, you know, rather remarkably and today. I have a daughter and if she has an ear infection, I mean they'll pretty much not prescribe an antibiotic until it gets very severe, and so I think that's a positive thing. Dr. Pereira, tell us a little bit about Biolytx, the company that you founded and as you mentioned in the very first segment you're both an academician and an entrepreneur and talk a little bit about funding for the basic research that will lead to that new drug, that new technology that will have this impact if you could.

>> **Anne Pereira:** Biolytx was a company that we founded in 2005 and this was based on the intellectual property that came out of the University of Oklahoma Health Sciences Center. So it's basically an OU spin off company, and our mission at Biolytx is to develop a novel therapeutic peptides. As I mentioned, peptides are small portions of big proteins and these bioactive peptides that we have discovered in my lab at the University of Oklahoma Health Sciences Center have in addition to the microbial activity and the ability to kill antibiotic resistant organisms, we've also identified peptides that can be very helpful in healing. Skin, dermal healing, wounds, healing of corneal scars, the corneal being the outer surface of the eye. So corneal wound healing, dermal wound healing and actually being able to kill bacteria. So there seem to be a great need out there in the community for drugs, for therapeutics that might be able to help in healing wounds rapidly, accelerating the healing or suppressing the scarring of a cornea once it's scratched or hurt. And ultimately to be able to find a drug that could be administered to seriously ill patients in hospitals for treating things like ventilator associated pneumonia and so on. And up to that point most of our funding had come from the NIH so it was all done at the what I would call the discovery stage, the basic grant from the National Institutes of Health. And at that stage I2E I was invited to give a talk I think it was called Lunch With the Scientists or something, and there were a number of people in the audience who were taken by the story of a drug that might be effective against hospital acquired infections. And so with a lot of help from I2E and others in the community and the health sciences center, the Tech Transfer Office, Biolytx was formed. And since then Biolytx has sort of limped along. We've managed to move things along with funding from OCAST which is through an OCAST [inaudible] grant, which was very helpful in getting some of the other work done and then more recently we had a very nice amount of funding from the edge and with the edge grant we were able to actually move this really rapidly on. We were able to do a lot of studies that funding agencies like the NIH do not fund because they're not considered mechanistic, they're considered more run of the mill. So this would be, you know, trying to scale up a drug, can you actually make things in a commercially viable form, can you actually measure the drug, how would you measure it in a patient or an animal. Also it's a study that the FDA requires for a drug to be move forward. And so I would say that we are in a stage of what's known as a pre-clinical. We're trying to get this drug to an investigation of new drugs application so that would be the next big milestone can we provide the FDA with all of the

requirements to show that this is a drug that would be valuable in a certain setting? And we've decided to move forward with the corneal information, the corneal wound healing indication as our first indication. Once we get to that I&D, it's only after that stage that one can actually perform any clinical trials. The first would be a phase I clinical trial where you're really looking at the toxicity of this peptide. So it would be in perfectly normal people, you're administering the peptide to the eye topically to determine if there is any toxicity. Then you go into phase II which is, you know, it gets you to the point where you are looking at a small group of people, numbers of people where you see the actual efficacy and then a phase III which would require much larger numbers of people. So that would be our first indication. The second indication would be our dermal wound healing. Surprising to say but the dermal market for wound healing is huge. There really are very few therapeutics out there. So you could have even wounds such as bed sores, those are very hard to treat once they become chronic. And so there's a big market out there for the dermal and that would be our next indication. These would all be topical.

>> **Gary Owen:** Sure.

>> **Anne Pereira:** The Holy Grail, of course, would be the systemic administration of a peptide to be able to treat seriously ill people in a hospital who might have infections due to pseudomonas.

>> **Chad Mullen:** And, Gary, I think it's interesting when you listen to Dr. Pereira's kind of timeline if you will there exist a tremendous funding gap whereas there is some as you say NIH some grant funding, government funding, university research funding for that kind of basic science level and once you get to clinical phase I or II you may have the opportunity to partner with a pharmaceutical company that might carry some of the burden and expense of that but there's a gap in between where there's a lot of things you have to do that are expensive things to do that require a lot of personnel and talent and equipment for which really not much funding exists and we did have a program here in Oklahoma previously, the Edge Program, and that was designed for that kind of gap that was there to keep companies like Dr. Pereira's and Biolytx here in Oklahoma and do it and so I hope one day we have the opportunity to do that again because there's certainly that's the phase where Venture Capital comes in at some point.

>> **Gary Owen:** Right.

>> **Chad Mullen:** And a lot of time when that occurs you're going to see the company head east or west at that point.

>> **Gary Owen:** I guess your next big challenge through the clinical trials is getting FDA approval to get it to market, right?

>> **Anne Pereira:** That's right.

>> **Gary Owen:** That's a big hurdle.

>> **Anne Pereira:** That's a big hurdle actually. Once again I2E has come to our rescue and we've just received very nice seed funding from the Angel Group.

>> **Gary Owen:** Wonderful.

>> **Anne Pereira:** That will take us through some of the very critical pre-clinical studies and we're hoping to be at that I&D stage within maybe the next 24 months at the very latest 18 to 24 months and so that this latest round of funding that we received in October of 2015 has really

helped us bridge that gap which was critical taking us to an I&D so once again OCAST I2E just amazing helped entrepreneurs here in Oklahoma.

>> **Gary Owen:** And I hope you and our listeners understanding that some of your tax dollars with OCAST that's where some of your science and technology tax dollars through OCAST that's how it's being applied. It's a great example of how the monies are distributed for great research and science like Dr. Pereira is putting out there on the table and we're hoping that in future years we're going to see this available the next time it's needed. We only have a minute left. We always like to ask our guests all this time look what you've worked towards what do you see in the next 3 to 5 years for you and your company? Where do you hope to be?

>> **Anne Pereira:** Well, hopefully we'll have a drug very close to a topical therapeutic for our corneal healing. Maybe we would move along so that we could actually look at the serious infections. We hope that we would have grown to the point that we would be able to hire and keep some of our graduate students and post docs.

>> **Gary Owen:** There's the bottom line, yeah.

>> **Anne Pereira:** And attract people here so that we can keep this company going in Oklahoma.

>> **Gary Owen:** Just another example of, Chad, what the University of Oklahoma Health Sciences Center is doing in research and education as well as invention I think it's great.

>> **Chad Mullen:** Amazing things coming out of there.

>> **Gary Owen:** All right, listen, we've got to get out of here. We appreciate you listening and we hope that you'll join us next time for another edition of *Oklahoma Innovations*. Have a great week.

[Music]

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