Oklahoma Innovations Radio Show

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Guests: **Zhibo Yang** and **Anthony Burgett**, University of Oklahoma Department of Chemistry

>> 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:** Thank you Andy, and welcome Oklahoma to another edition of Oklahoma Science Radio Magazine. *Oklahoma Innovations*. Tessa North, my co-host. You having a good summer?

>> **Tessa North:** So far, so good. Although it's supposed to start getting really hot. And I am not very excited about that.

>> **Gary Owen:** Well, I'm sorry. Of course, I guess it's kind of rough when you have children, isn't it?

>> **Tessa North:** It is. It's really hard to get outside.

>> **Gary Owen:** You have been a busy lady at OCAST because you've been giving away some money. I say she has been giving away money, but OCAST. But, she, because Tessa is involved in the Programs Division at OCAST. So a lot of grants executed recently. Talk about those.

>> **Tessa North:** Yeah, that's right. In recent weeks we have given away about $6.2 million in grant money. And I say given away, but really these are grants that were hard-earned by our applicants. They were all peer reviewed from out-of-state experts. And we are pleased that we were able to award 46 new grants within the last couple of weeks. We had 22 applications for our health research program that received funding, 16 for our applied research, three in our plant science and five in our interns program. So there are a lot of new projects that are about the get underway here doing a lot of good for the state of Oklahoma.

>> **Gary Owen:** Now, some of our listeners may not understand how this works. Give them a quick review, if you will, of how this process works. I'm a scientist. I'm looking for some financial aid to get my project launched. And I've applied for a research grant at OCAST. And we -- I guess a good label to say is this kind of some seed funding, isn't it? Is that a good way to position that?

>> **Tessa North:** Absolutely. That's exactly how we like to think of it. These aren't huge grants. Our largest one is for $300,000. And that's in our applied research program. So, basically anybody who has a cool idea for something that could potentially benefit Oklahoma's economy or, you know, something that they just want to investigate further in terms of health research,

something that may make, you know, healthcare or treatment of disease better, they're welcome to apply to any of our programs. The programs are really sort of open in terms of the ideas that are accepted. We don't have specific topics that you have to address. You just have to fit into a broad area of research. And once you submit an application, we bring in some reviewers from outside of the state who are experts in their respective fields. And they read each proposal and rank them and recommend to us that we fund these top however many projects we have money for. And then our board approves it. And ultimately we end up going to contract with these applicants.

>> **Gary Owen:** And these projects are the ones that show true promise, right?

>> **Tessa North:** Correct. In terms of our applied research program, these are projects that have both economic impact potential and also have a good strong research plan. For our basic research programs like health and plant science, the reviewers are just looking at the science. Is there a quality team set up? Do they have a good idea? And is it likely that they can carry this through to a successful end goal. In our intern program, we're just looking for a really good real world type of experience for undergraduate students to get out in some sort of industry setting.

>> **Gary Owen:** Hmm, interesting. So, you have a spotlight on an Oklahoma business this week?

>> **Tessa North:** That's right. And actually, the thing that I wanted to talk about today is something that I learned about recently through our awards that we just made for our awards program. And I'm a big animal lover, so I really liked this particular project.

[Dog Barks]

There's a dog in here today. We recently funded under our OARS program a project that aims to make the training of explosive-sensing dogs safer and more effective. So, lots of times the military or police, you know, government agencies like the postal service or whatever, might employ canines that help to sniff out explosives. Training for these explosive-sniffing, sensing dogs usually dictates that live explosives are used. But for various reasons, that's not always the most practical thing to do. You know, it's really expensive. It's certainly very dangerous for both the dog and the handler. And it just takes a lot of specialized manpower to do training, to conduct training with live explosives. So there's a company in Stillwater called Explosafe that has developed safe and effective training aids for a host of explosive materials. This project has been funded under the OARS round recently. It will make these training aids that are -- they allow the trainers to use live explosives. But these aids sort of negate any explosive effects that could happen to these training tools while the dogs are out sniffing around on them. Because apparently some of these explosives are super sensitive to heat or movement or whatever. So, these training aids developed by Explosafe under this OARS project will keep the explosives from, you know, becoming -- from detonating. But it will also allow the odors, the vapors, to still escape from the training aids so that the dogs can still sniff and, you know, actually practice on these live explosives. So, it sounds like a win-win-win situation. The dogs stay safe. The handlers stay safe. Money is being saved. And for all of us, we get more canines that are employed and are, you know, patrolling around our airports and postal facilities keeping us safe for potential explosive devices.

>> **Gary Owen:** That's very cool. Before I do our innovation in history for the week, we want to talk about our subject matter for the show this week. Because if you just got in the car and you're

headed out to do something for the weekend, we want to tell you about -- this is going to be an interesting show. You know you always hear about researchers doing wonderful things on the cellular level -- that's a hard word to say this time of day. But anyway, we're going to talk to two scientists who are involved in the bio side using what -- we've used this term before -- spectrometry research. We have two scientists who are going to tell us today about a new discovery. This new discovery is allowing them to get inside a single molecule. And if I've termed that right. And we're going to find out more about what this means. But it's two guys that have kind of come together. And real promise for cancer research as well as other research. It's going to be really interesting. Now, for those of you -- I would call you baby boomers, because if you go back to the '50s and '60s, this would bring you kind of into the memory, if you will. A lot of the young people that might listen to this show who are video game people wouldn't get this. But, if you were a game player back in the '70s, you'll remember this. All of you game players out there that were really active in games, video games, listen to this. It was in June of 1972. Video game company Atari -- does that name? Oh, sure, it rings a bell. I bet you didn't know this. Atari really means to hit the target in Japanese. That's right. You didn't know that, did you? Well, anyway, Atari was founded back in 1972. This video game company led to the debut of their first video game called Pong, P-O-N-G. A simulated tennis game with very basic graphics, Pong was the first video game that had commercial success and was imitated many times over by different companies thereafter. Though Atari is no longer the leader in video gaming that it once was, it opened the door to the video game industry we know today. How about that?

>> **Tessa North:** I remember playing an Atari.

>> **Gary Owen:** Do you?

>> **Tessa North:** When I first started playing video games.

>> **Gary Owen:** Oh, okay. Very cool. All right. Well, all right. So let's get on with our guests. And I will tell you that our fist guest, his name's kind of a challenge. Zhibo Yang, is that right? And you are at the University of Oklahoma Department of Chemistry and Biochemistry along with your associate, Anthony Burgett, who is Assistant Professor of Chemistry and Biochemistry at OU. Gentlemen, welcome to the program. We want to talk first of all with Zhibo. Tell us a little bit about yourself and how you came to OU.

>> **Zhibo Yang:** Good morning. My name is Zhibo Yang. You can call me Dr. Yang.

>> **Gary Owen:** Okay, Dr. Yang. We'll do it that way, okay.

>> **Zhibo Yang:** Yeah, that also makes me feel better because I feel younger.

>> **Anthony Burgett:** Oh, he uses that all the time.

>> **Zhibo Yang:** All right. So I originally come from China. I did my bachelor and master degrees at the University of Science and Technology of China. And then in the year 2000 I came to the Detroit.

>> **Gary Owen:** Detroit?

>> **Zhibo Yang:** Yes. I did my PhD at Wayne State University. After that I had been working as a post-doc, which is more like a research scientist at Pacific Northwest National Lab as well as University of Colorado, Boulder. And then in year 2012 I came to Oklahoma and joined this department and became an assistant professor.

>> **Gary Owen:** So you've been at OU since 2012, is that right?

>> **Zhibo Yang:** Exactly.

>> **Gary Owen:** All right. And Anthony, what about you?

>> **Anthony Burgett:** Well, I actually grew up in Oklahoma, outside of Tulsa, and did my undergraduate at OU. But then I left the state for my education, doing my PhD in Dallas at UT Southwestern Medical Center and then followed by a post-doctoral fellowship at Harvard in Boston. And then I went out on the academic job market and happened to have this opportunity to come home, back to OU.

>> **Tessa North:** Awesome.

>> **Gary Owen:** You know Tessa, what I find interesting is these guys, if they leave the state, they come back. If they've never been here, they come here. And they stay and love it. Isn't that amazing?

>> **Tessa North:** It's a pretty cool place.

>> **Gary Owen:** And then we find out what kind of research projects are going on here in the state and it's like wow! That's going on right here in our backyard.

>> **Tessa North:** I know. It's pretty amazing.

>> **Gary Owen:** All right gentlemen, let's talk a little bit about the science. And we've got to start with the basics. I guess we need to start on the level of mass spectrometry, is that right? Spectrometry. You've got to put that R in there, Gary. Spectrometry. Talk about the tool that you use. That's fascinating. I wish this was television so we could kind of see it in operation. So, if you can, kind of give us a visual description of what this tool does.

>> **Zhibo Yang:** All right. Mass spectrometry is an important analytical technique that people can use to [inaudible], to detect, to identify unknown molecules. You can imagine that this kind of technique is usually performed by using an instrument called a mass spectrometer. So you can imagine that mass spectrometer is more like an actual skill. Everything stand on the skill -- oops, I had too much [inaudible]. So you can try to mirror the weight of molecule for your identification. When we do the studies we usually generate the ions from molecules.

>> **Gary Owen:** Study the irons of molecules?

>> **Zhibo Yang:** Yes. You have molecules in the beginning. Then you put a charge on that. We call this process ionization.

>> **Gary Owen:** Oh, okay. We've heard that term before.

>> **Zhibo Yang:** Yeah. Then you can manipulate ions by using magnetic field or electric field. And by using all kinds of techniques you can [inaudible] the weight of the ions. And eventually the information you get is M over Z, which is mass-charge ratio. And by accurately [inaudible] the mass-charge ratio, you can try to detect and identify the molecules. So, that's how it works.

>> **Gary Owen:** Okay. So Anthony, where does your collaboration come into play?

>> **Anthony Burgett:** Oh, well my research is the chemistry and biology of drug development. We use mass spec typically to --

>> **Gary Owen:** Okay, hold that thought right there. We've got to take a break. We'll come back on *Oklahoma Innovations*.

[Music]

>> Pancreatic cancer is the fourth leading cause of cancer deaths with a median survival range of 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 are 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.

>> And now back to *Oklahoma Innovations* with Gary and Tessa on the OCAST Radio Network.

[Music]

>> **Gary Owen:** All right. Sorry we ran over the previous break there before Anthony had a chance to talk about his involvement with Dr. Yang and this new process we're about to learn about. Now, the spectrometer. Talk about that, if you will. Because you guys have kind of an abbreviation for that, right?

>> **Anthony Burgett:** Yeah. I mean, typically you can refer to it as mass spec. As Zhibo said, mass spec is one of the most commonly used analytical methods in science, and really in all of our society. It has unparalleled sensitivity, the ability to identify molecules in really incredibly quantities. So I use mass spec in a lot of my research. But Zhibo is really an expert in developing new technology around mass spec applications. And really, this collaboration that we began with Zhibo's idea and invention of a new way of applying mass spec to detect very, very small sample sized -- very, very small samples.

>> **Gary Owen:** So, if I understand right, what we're talking about is this is an area that we've never been able to accomplish before is looking inside a single molecule. Is that what I understand?

>> **Anthony Burgett:** Inside of a single cell.

>> **Gary Owen:** Cell, okay.

>> **Anthony Burgett:** So, mass spec has been around for how long, Zhibo?

>> **Zhibo Yang:** Probably the idea came out in year 1880s. But the first application actually occurred in World War II during the Manhattan Project.

>> **Gary Owen:** World War II.

>> **Zhibo Yang:** Yeah. People wanted to use mass spectrometer to enrich uranium isotopes. And after the wars, technologies had been developed so fast. And since 1980s mass spec has become very, very popular in science research, in pharmaceutical companies and in many, many places.

>> **Gary Owen:** Well, I know we've used that term on a few shows in the history of this program. And so I know it's used widely in the lab for various applications. But this -- the reason this caught our interest is because of the research you guys are just kind of on the cusp for cancer. But now, Dr. Burgett, you've been doing cancer research for a while in your lab, right?

>> **Anthony Burgett:** Yeah and in my training. You know, I have training in sort of making new molecules that might have anti-cancer activity and understanding how those molecules work, with the ultimate aim in developing new anti-cancer drugs. So, you know, my lab is really sort of focused on chemistry and biology of cancer. That's why I was very excited for Zhibo's new technology to be invented because it has a transformative potential to allow the investigation of cancer cells on the single cell level, which has never existed before. The last five or ten years, cancer biology has really shifted its focus to understand that the single cell level is the most important level for cancer proliferation and disease biology. But we really lack the analytical tools that allow us to interrogate and investigate cancer cells on the single cell level. Zhibo's technology, his invention, is perhaps the best and first vehicle we have to really start asking really interesting questions on the single cancer cell level.

>> **Tessa North:** Wow. So that's pretty impressive. So, how long did it take you to develop this technique?

>> **Zhibo Yang:** Maybe about a year.

>> **Tessa North:** Really? That quickly?

>> **Zhibo Yang:** Yes.

>> **Tessa North:** So, are you still the only person -- are you guys still the only people doing this or is it starting to catch on yet? Or is it still so new that other people haven't caught wind of what you're up to?

>> **Zhibo Yang:** I would say there are a number of groups doing single cell lab studies. But most of them have to put the cell in a vacuum, which means they are going to kill the cell. We probably is one of the most advanced groups that we could study live single cells at their growing conditions.

>> **Tessa North:** That's awesome. So what sort of a benefit does this versus something, I mean, I guess for the lay people among us and for myself, what is the benefit of being able to study a live cell versus, you know, a vacuum cell that ultimately will be dead? So, how much of a benefit is that?

>> **Anthony Burgett:** Well, I think any time you're doing the experiment it's very important of how artificial your system is going into that experiment. And so if you have to take a cancer cell and manipulate it or destroy it or affect it in some way, whatever results you have from analyzing that affected cell are going to be compromised to a greater or lesser degree.

>> **Tessa North:** Right.

>> **Anthony Burgett:** With Zhibo's technology, in essence, from one moment the cancer cell is normal, living and the next instant is being analyzed for its complete molecular makeup of what exists inside of that cancer cell. So it's potentially, you know, a step forward in what we can understand of what's happening on the single cell levels.

>> **Tessa North:** Hmm. That sounds really exciting for the field in general. That's pretty awesome.

>> **Gary Owen:** So, does this give you a new edge in the development of new cancer drugs?

>> **Anthony Burgett:** It definitely opens doors in that direction. One of the most direct applications of Zhibo's technology is for the first time we can actually determine how much anti-cancer drug gets inside of a cancer cell.

>> **Gary Owen:** Wow.

>> **Anthony Burgett:** You know, if you think about the process of how we administer chemotherapeutic agents in patients, it almost always is the patient is dosed over several weeks or several months. And then at the very end of that dosing regimen there's some sort of endpoint analysis to determine the effectiveness of the drug, usually a scan of some kind. So there's no real-time information for the physician to understand are they dosing the right amount of drug? Is the drug even getting inside the cancel cells? There's no readout that would allow for the tailoring and personalization of the chemotherapeutic drug regimen to be applied. So that was one of the applications that we're most excited about for Zhibo's technology is in a clinical setting to determine how much cancer drug is getting inside of the patient's cancer cells using mass spec.

>> **Gary Owen:** Interesting stuff here, folks. We have a lot more to learn on this program. And see, science is cool. It really is. More to come when we return on *Oklahoma Innovations*.

[Music]

>> Don't go away. There's a lot more to learn on *Oklahoma Innovations* with Gary and Tessa on the Oklahoma Radio Network.

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>> 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*. You never know what we're going to talk about on this program. This week we're talking with a couple of scientists from the University of Oklahoma. Dr. Zhibo Yang. He is an assistant professor and he deals with what we call spectrometry. Try to say that real fast three times. And we're calling it mass spec for short. And Dr. Anthony Burgett, Assistant Professor of Chemistry and Biochemistry at OU. And I want to kind of give you an overview. If you missed part of the program, what these guys are doing. Single cell mass spec is kind of where these two guys joined partnership. And to kind of give you an overview from their bio, all living organisms are composed of individual cells. You may remember that from science class. Whereas cells are different from each other. Traditional cell analysis methods can only provide the averaged results from a population of cells. Single cell analysis can potentially revolutionize approaches for cell biology and pharmaceutical research. Now, Dr. Yang has developed a miniaturized sampling and ionization device, or at least a process using mass spec. A single probe to be coupled with the mass spec for single cell analysis. Am I saying that right so far?

>> **Zhibo Yang:** That's correct.

>> **Gary Owen:** Okay. And so the sampling tip can be inserted into individual living cells to sample the intercellular compounds, which are immediately ionized and analyzed by the mass spec technology in real time. Now, this technique has been utilized for sensitive detection of anti-cancer drugs and cell metabolites inside of living single cancer cells. The technique can possibly be used to analyze rare samples such as cancer stem cells and patient-derived cells. Now, I tried to paint a picture here so that our audience kind of gets a handle on what we're talking about.

>> **Tessa North:** So, right before the break Dr. Burgett was talking about or mentioned something that I thought was really interesting. And we've done shows on this in the past. The personalization of medicine. And I think that, if I understand correctly, this new technique could potentially allow for, especially in cancer treatment, the personalization of chemotherapy or whatever other treatments may be involved with fighting that cancer. Because may be involved with fighting that cancer especially in cancer treatment, the personalization in metabolites inside of you'll be able to see exactly how the medication is affecting the cancer cells or how much is, you know, of the medication remains in the cells so that possibly treatment could be altered during its course. Is that a possible outcome from this?

>> **Anthony Burgett:** Yeah. I think it's one of the most exciting applications of Dr. Yang's invention.

>> **Tessa North:** Awesome. And Dr. Yang, during the break we were talking about how you recently filed a patent for this. So this is, I mean, this is new and exciting and hopefully, you know, you're the first person to come up with this. And so I think this sounds really cool for,

certainly for the University of Oklahoma, but for Oklahoma, you know, the whole of Oklahoma, and hopefully, eventually people even outside of the state. So, kudos to that. It sounds very exciting. So, your project, you are actually funded under an OCAST project right now, under Health Research Project, correct?

>> **Zhibo Yang:** That's correct.

>> **Tessa North:** And so, the project title is "Single Cell-Level Mass Spectrometry Analysis for Anti-Cancer Drug Pharmacology." So can you tell us a little bit about what it is that you're doing under this project and how the two of you are working together on it?

>> **Zhibo Yang:** Well, our research is focused on using mass spectrometry for bioanalysis. So one of the projects we are working on is to use our new technology to study single cells. So we have invented this technology. And fortunately I found my colleague, Dr. Burgett, is a perfect collaborator with us. So we decided to work together. He can provide some biology background, pharmaceutical background. And we can use our technology to study those anti-cancer drugs and the influence of anti-cancer drugs on the cancer cells. So that's, in general, how we work together.

>> **Tessa North:** So, one of the -- we've talk a little bit about -- we've given an overview of what this technique involves. But there is something that we haven't really talked about is there's like a probe that you have developed, correct? So you haven't invented a whole new machine. Tell us a little bit -- can you talk a little bit more in depth about what it is that you have invented with this?

>> **Zhibo Yang:** Sure. The invention is called a single probe. That is a super tiny probe. If you think about the size of cells, they're less than 10 micrometers. To give you an example, the average diameter of a human hair is about 100 micrometers.

>> **Tessa North:** Oh, my goodness.

>> **Zhibo Yang:** Whereas the cell is about 10% size of the diameter of a hair.

>> **Tessa North:** So, we're talking teeny. Like, you could never see this.

>> **Zhibo Yang:** Right. And the probe we made is even smaller. The tip is about 5 to 9 micrometers.

>> **Tessa North:** Oh, my goodness.

>> **Zhibo Yang:** So we use a laser puller to pull this tip. And we can make from quartz. Then by using a microscope we can gradually insert the tip of a probe into a cell. And actually, this tip has two channels inside. Using one channel we can provide solvent to wash out the contents inside of a cell. And using the other channel we can deliver -- sample the molecules directly towards the mass spectrometer for analysis. That's how it works.

>> **Gary Owen:** You know, to give our audience a visual of what he's talking about, think about perhaps a science news story you've seen where you see them inserting a tool, a probe of some sort into something under the microscope. You know, like probably a good example of that is in a Petri dish or in an application like fertilization, for example. We know that in in vitro fertilization. Think about that. Okay, now take that science down to a much, much smaller level. We're talking itsy bitsy teensy weensy, okay?

>> **Tessa North:** Technically.

>> **Gary Owen:** My fancy here is how do you develop a tool that tiny to go into a cell? That just boggles my mind.

>> **Tessa North:** I cannot wrap my head around that.

>> **Gary Owen:** No.

>> **Zhibo Yang:** Well, maybe I should tell a little bit more about mass spec. This technique is so sensitive. To give you an example, if you take a pill of ibuprofen, like this small, and you throw that into Lake Songbird, and dissolve this pill. In principle, you should still be able to detect ibuprofen from Lake Songbird. So you can imagine how sensitive this technique is.

>> **Gary Owen:** Right, right. Yeah.

>> **Zhibo Yang:** Okay, then we come back to single cell. Since it is so small, you have to have created some -- you have to have used some technique that is sensitive enough to detect the species inside. This is one thing. The other thing is the size. You have to create a probe, a little spot, that is comparable to the size of single cell. So eventually you have to put two things together to detect a single cell. In our lab originally we were interested in the -- we call this mass spec imaging. That is technique to map the spatial distribution of compounds like anti-cancer drugs on the tissues, like brain, kidney, tumor. We are trying to make the probe smaller and smaller and smaller. And then eventually we found the tip we made can be even smaller than a cell. And how we came up with this idea of inserting the tip directly to a live cell and detect the cellular contents.

>> **Gary Owen:** Oh, man. What kind of material are you using to develop this probe?

>> **Zhibo Yang:** As I Just said, it's made from quartz. So we brought those quartz tubing which has two channels already. Then we use a laser puller to pull it.

>> **Gary Owen:** Oh, a laser puller?

>> **Zhibo Yang:** Yeah. Just make a sharp quartz needle.

>> **Gary Owen:** Oh, okay. Yeah, got it.

>> **Zhibo Yang:** That's how we make.

>> **Gary Owen:** Got it. All right, so now we've got the process. We've got the process under patent. And we filed for a patent for this process, which I assume as the future goes, this patent, this technology is going to be available to other labs at some point, the technique? Because you're not the only lab that has a mass spec piece of gear. So this is something that will adapt to other labs, is that correct?

>> **Zhibo Yang:** Yeah, that's correct. One of the benefits of our technology that this device can be broadly adapted to many types of mass spectrometers, not only our instrument, but also the instruments in other people's groups. So eventually we hope we can commercialize this technique. And there's some [inaudible] can purchase a patent and make some mass production of the probes. Then people just buy the probes and buy the device and hook up the thing onto their instrument. They can study single cells.

>> **Gary Owen:** And this technology will be available for not just medical applications, right? I mean, we're talking about plant biology, I would assume. Where else could this go?

>> **Anthony Burgett:** Yeah, I mean, any cellular system that would be beneficial to do a single cell analysis, it could be applied to that. And not even just cells, but any situation where you had a very miniaturized sample that needed to be analyzed, the single probe could be applied for that.

>> **Gary Owen:** That's fascinating. So where is all this going to go? What is the future for cancer therapies? And possibly -- and other treatments? Well, we're going to find out where this will possibly go when we return on *Oklahoma Innovations*, your science radio magazine. Don't you go away.

[Music]

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[Music]

>> **Gary Owen:** We hope as you listen to this program this week that you're wrapping your brain around some of this descriptive ways of trying to get across the radio what our two guests are doing when it comes to research in biochemistry at OU. We're talking about mass spectrometry and how they've developed a probe to do further investigation on single cells. It hasn't been able -- they've not been able to that before on this level. And it's pretty incredible. And the future is amazing.

>> **Tessa North:** That's right. I think that this sounds really fascinating. And I would be so interested to see this in action, sort of. So if you are interested after listening to this show today, if you are interested in seeing a video of how this might work, check out the OCAST Website at OCAST.OK.gov and we'll actually have a video from Dr. Yang showing his tool in action. So, check that out. I think it'll be really good to illustrate everything that we've been talking about today. Because I know that I cannot even imagine how this must look. Because it's so -- what was the technical term you used? Teeny tiny.

>> **Gary Owen:** Well, it goes back to the song that many of our listeners will know: itsy bitsy eensy weensy -- okay. So there you go. Obviously you've had some great input here. And you've had some assistance from OCAST, which is cool. Where do we go from here? The patent's been filed. You've had the celebration of realizing that your technology works successfully. It took you a year to develop the technology. So now, with your collaborations, obviously, the goal here is the future of cell studies, hopefully, for some new anti-drug discoveries, I guess. Tell us what is your vision in the next five or ten years using this technology? Where do you hope to -- what do you hope to see?

>> **Anthony Burgett:** Well, the technology allows us to investigate biology and drug pharmacology on a level that hasn't been accessible before. So we're not only going to use it as a tool to uncover new understandings of basic cellular biology, we're also going to be able to use it as a tool to understand how anti-cancer drugs work in cancer cells. And to maybe use that as a launching pad to develop some new classes of anti-cancer drugs. So that's sort of the basic research that the invention allows to happen. There's a much more applied clinical application of this technology, too. And that is, as we mentioned before, the possibility of using this to better administer drugs in actual patients. So every hospital lab has a mass spectrometer already. Every drug testing, you know. If you go into the hospital and they send out things to labs, many of the tests they do use a mass spec. With this new sampling technology, it might be possible to develop defined applications in a clinical setting that single cells could be analyzed from patients to affect their treatment in a beneficial way.

>> **Gary Owen:** Do you see that this technology could be used to help scientists in the pharmaceutical industry refine drug therapies? Because now they would be able to insert, I guess, anti-drug molecules into a cell and see how it reacts? I mean, that seems to be the biggest issue with cancer drugs is what kind of reactions are the patients going to have? And how is it going to beneficial?

>> **Anthony Burgett:** Yeah, we actually have a collaboration with Dr. Jonathan Highland at the Stephenson Cancer Center, who is a urologist, to provide bladder cancer cells from patients who have undergone chemotherapy treatments. So, the bladder cancer cells are accessible in the urine of the patients. We will actually use Zhibo's technology to determine how much anti-cancer drug is actually inside of these cancer cells from patients. So you can imagine the direction and the applications of this that instead of a patient going in and being dosed with chemotherapy and waiting weeks to determine if it's going to work, that same day, potentially, there could be some information if the cancer drug is getting to where it needs to go in the patient and is it getting inside the cancer cell? And then is it having some effect?

>> **Gary Owen:** More accurate targeting, I guess.

>> **Anthony Burgett:** Yeah, exactly.

>> **Gary Owen:** Specified targeting. And another thing that we haven't talked about here is with this application, as you know, nanotechnology is very much coming into the forefront for more specific targeting to cancer tumors and those kinds of things and refinement of the cancer. So everything you guys are doing on the molecular level is just becoming more refined and more targeted and more specified. And in the medical field, they're trying to make the therapies and treatments less invasive and with fewer side effects. And it sounds like what you're on, you're on the cusp of helping them make that even better.

>> **Anthony Burgett:** You could personalize the drug treatments to a level of accuracy that hasn't been possible before.

>> **Tessa North:** And is there -- is this applicable or could this potentially be applicable to diseases or disorders other than cancer? Or is there something unique about cancer that it would only work for that?

>> **Anthony Burgett:** No, no, it would work. Anytime you had a small molecule drug being administered to a patient and you wanted to see how much of that drug got inside of the cells, you could potentially use this method.

>> **Gary Owen:** Yeah, I could see this being applied in muscular disorders, very much so. That's just great. All right, guys. One thing we haven't talked about is your research team. Because you don't just do this by yourself. You're surrounded by a lot of intelligent people. Talk about that.

>> **Zhibo Yang:** Well, I have a nice group with me. I have two research scientist. Wei Rao and Ning Pan. And five graduate students. And so we are working together on many projects. And you?

>> **Anthony Burgett:** Yeah, I mean, Zhibo and I both arrived at OU at the same time three years ago and built these research groups. You know, my post-doc Dr. Naga Rama Kothapalli has especially been important in this collaboration. She provided a lot of the cancer cell biology expertise we needed in making this happen. And it also has been really possible due to the research that's going on at OU now. You know, I did my undergraduate at OU many years ago. And in the time since I graduated and came back, the school has undergone a sort of a quantum leap forward in research capabilities. We are in a new research building on a research campus that didn't exist ten years ago. It's a very exciting time to be in the Department of Chemistry and Biochemistry and at OU.

>> **Gary Owen:** So Dr. Yang, what's next for you? I mean, you made this wonderful discovery. And it's kind of like, well, that was cool. I've got to move on. So what's next for you?

>> **Zhibo Yang:** Well, next step, actually we have different parallel projects. One thing is to improve the design of this single probe, the current design, so we can make it a lot easier to make so then people can make it to be commercialized. On the other hand, we have invented a new technology I haven't mentioned here. So that probe is called a T probe, is even smaller. And we hope we can study subcellular level in the future with my collaborators like Dr. Burgett.

>> **Tessa North:** Even smaller?

>> **Gary Owen:** Yeah, they get any smaller it's going to disappear. I don't' know how they're going to do that. Wow! That's -- or be invisible. Go ahead.

>> **Tessa North:** During the break we were talking about potential different applications for this in the future. And you had mentioned that, you know, at the very beginning of the show, I was talking about the bomb sniffing dogs like at an airport. And you mentioned that there could potentially be an application for this in a similar type of situation for, I guess, detecting explosives or something similar. Can you explain a little bit about that?

>> **Zhibo Yang:** Yeah, you are correct. A mass spectrometer is so sensitive, I've mentioned. Actually people have developed a mass spectrometer that can be used in airport to detect explosives or illegal drugs. For example, probably in Denver or in Indianapolis, there are instruments like this. So when the passengers step into the instruments, more like a door, security door, and the air will blow towards you and blow away the particles on your clothes or hair. Then those particles will be collected by the mass spectrometer. And the instrument will give the information about the composition of the particles. And by comparing the database, security guys can quickly identify if the people carry some dangerous or illegal compounds.

>> **Gary Owen:** Interesting. Good stuff. What about you, Dr. Burgett? Where do you see your future going?

>> **Anthony Burgett:** Well, I think this collaboration, the technology Zhibo's developed, allows my research group to ask some really interesting questions of both the cancer cell biology. You know, what makes a cancer cell a cancer cell? And how cancer cells respond to the drugs. And also, it's going to be a very important tool in some of the chemistry we're launching to try and develop some new class of anti-cancer molecules. So to some extent, it gives us a capability that few if any other research groups have.

>> **Tessa North:** That's really exciting. Right here in Norman, Oklahoma.

>> **Gary Owen:** That's right. You guys have been wonderful. And I know it's a little difficult to kind of describe this on the radio, but you've done a great job of that.

>> **Tessa North:** And be sure to check out our video.

>> **Gary Owen:** Oh, absolutely. That'll be up. So check it out. And pass this on to a lot of your friends. It's very cool. And we have some interesting shows coming up in the future our producer Debbie Cox has told us about. And I know you're going to want to check them out. So we appreciate you listening each week. And we hope that you find this very wonderful educating programming here on your radio. Thanks for joining us this week on this edition of *Oklahoma Innovations*. Have a great week.

[Music]

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