Narrator & Editor Richard Gay: This is 30 Brave Minutes, a podcast of the College of Arts and Sciences at the University of North Carolina at Pembroke. In 30 Brave Minutes we'll give you something interesting to think about. Joining Jeff Frederick, the Dean of the College of Arts and Sciences is Dr. Karen Farizatto, a research assistant professor at the UNCP Biotechnology Research and Training Center. Get ready for 30 Brave Minutes.

Frederick: Think for a minute about how critical scientific research is to our future. According to the National Cancer Institute more than one out of every three Americans (38 plus percent) will receive a cancer diagnosis at some point in their lifetime, most after they reach the age of 50. The rate of growth, internationally, is climbing even as the death rates for many forms of cancer in America are improving. By 2050 the world will cross the 9 billion population threshold, making scientific agriculture a critical element for feeding the occupants of the planet. That additional population, 2 billion more than today in 2019, will also create opportunities for infectious disease to spread, require even more renewable sources of energy and some innovation on disposal of waste products of all types. Lest we think the sky is falling, every reason exists to believe that the glass of water is at least half full, maybe more. At the risk of crudely summarizing the broad institute's description, crisper innovations clustered, regularly, interspaced, short, palindromic repeats, is creating interesting opportunities for gnome editing. CRISPR is both the scientific and specific term, and a shorthand of sorts for ways and systems that can be programmed to target specific stretches of genetic code and to edit DNA at precise locations. Researchers then, can permanently modify genes in living cells and organisms. And in the future may make it possible to correct mutations at precise locations in the human genome in order to treat genetic causes of disease. The future is also very bright in cellular agriculture, brain-computer interfaces, nerve regeneration, and prosthetics. Corporate and academic researchers and funders have seen the possibilities of these new pathways of research and optimism is high on many fronts. Some important biotech research is occurring right here on the UNCP campus in various labs, in classrooms and drawing boards. Dr. Karen Farizatto is a research assistant professor in the UNCP Biotechnology Research and Training Center and she explores multiple pathways at the molecular and cellular level and their effect on neuronal connections.

These research initiatives relate to any number of neurological illnesses and conditions including Alzheimer's disease, Parkinson's, brain cancers, and post-traumatic stress disorders of various ideologies. Karen is with us today to shed some light on her research and to help us understand some ideas that are challenging but are touching more and more families every year. Hi Karen. Welcome to 30 Brave Minutes.

Farizatto: Hello. Thank you for having me here. So I'm just very excited to talk about the research that we do here at UNCP and about my career and things like that.

Frederick: That's awesome. Great. Well, let's start with the basics. Tell me about your background; why did you become a scientist? How did that all unfold?

Farizatto: Okay, so I think the first thing for you become a scientist you need to be very curious about how things works, so I always was curious to see how animals behave or things like that and then I did my bachelor degree in biomedical and I was debating with myself, if I should go to the medical school or stay in the biology field etcetera. And then I decided to be a scientist because I would like to see how things works, not too clinical, not get in touch with patients but understand how cells function and all the processes that we have happening in our body. So and then after my bachelor degree, I had my first experience in a neuroscience lab in Brazil, the country that I'm from. So, there I was studying how the brain works, and on how the brain is manager of the heartbeat and all the neural systems, stuff like that. And then, after that, I was working on my PhD. Then I start understanding how the things occur when we have a disease going on. So then, on my PhD was when I first started working with Alzheimer disease, this was in 2010.

Frederick: So you grew up in Brazil, you got interested in animals, and a variety of other things. You wanted to know how things work and so you started to consider what you might do to answer those questions and you became a scientist.

Farizatto: Correct. And I fall in love. I fall in love. So the labs, the research lab was where I found myself and said, okay, yeah, this is exactly what I'm going to do for the rest of my life.

Frederick: Well I can't wait to hear more about that. Let's talk for a little bit about how similar or different schools are maybe in Brazil than the United States. What were some of the experiences you had growing up that got you so excited about answering these questions.

Farizatto: Okay, is a very great point, for we address. Is a little bit different. I see here in United States all the research is dedicated for the community. I see the relationship with the community, bringing students, and high school students to the college, let them experience a little bit more about what we do here and what do we do with research. What you can become in other type of careers etcetera, other types of jobs. So is a little bit different. So everybody knows that Brazil, the country that I'm from is a third world country, so we don't have all the technology that we have here in U.S. I had a great opportunity to come here with Dr. Ben Bahr, so when I was working with my PhD and this is what I say every time for students, how being a scientist you have an international career, because you can make a network. You can talk with people who are in another country. So I was writing a year report for my funding agency there for my scholarship and then I always used to cite a Dr. Bahr reference like his works to support my research line there. And then Brazil at that time was offering scholarships for students go abroad, learn techniques in countries like Key West or Europe and I applied for one of these funding, this scholarship. And then I thought okay, so let me contact this professor and let's see what he answer and I was running out of my time because we should go out abroad and then come back before I hear we have, you know, defended the thesis, stuff like that. Then I contacted Dr. Ben Bahr, and he replied the same day after I sent him email in the morning and he

replied and he said yeah, oh good to hear that you're also a scientist, very exciting. Of course, you can join my lab. And then he explained a little bit more about the current research that he was doing and then.

Frederick: So you're a Brazil, you're doing your own work, you're trying to get all of your degrees done, and get all your projects done, satisfy your funders for your research and the digital world of the 21st century brings you in connection with Dr. Bahr's research. You reach out to him, express your interest and then he gets back and says, why don't we work together? And that's how someone leaves Brazil and comes to Southeast North Carolina?

Farizatto: Correct! Everybody asks me how you got here? So this is the answer. So I contacted him. I never met him before and then he said, yes, you can join my lab. And then after that I came to here. I have amazing time here. I learned a lot of things and we started this connection. So we started this network. When I came back to Brazil, I finished my PhD and then he invited me to come back here as a researcher.

Frederick: And so, all researchers, all academics work a little bit differently. My area is history and so I spend a lot of time in archives pouring over old documents. Talk to us a little bit about how you do research. What is the lab like? What's the process like? Tell us about a typical day?

Farizatto: Okay. So, on a typical day we are in the biotech center here out of campus of UNCP and then Dr. Bahr and I, we have our research related with neuro-degenerative disease and then we try to understand how cells get sick. And then what is going on in at molecular levels that leads to the cells become, you know, do not regenerate and then start to trigger the disease. So we have several UNCP students that also joined Dr. Bahr's research there and when they get there, we also say to them, okay, so you guys have the background from the college, but now let's think big to small. So what do we do here? We try to see how cells work. So big is the function and so we see the body of a person walking, so behaving etcetera. But okay, let's go in and see how the cells works to make this amazing machine that is our body, especially the brain.

Frederick: So you start with the biggest possible picture that you can imagine and then you compress it down until you get to a very specific portion of how the body works and then you try to unravel that?

Farizatto: Exactly. So the students have this experience. This is how is very important. They immerse themselves. For this opportunity to experience how a research lab works, so not necessarily everything that we see in the college is explain everything. So there is when they have experience to see, to think logical, and of course becoming a problem solver, because not everything works so good how we think we would have liked that things would work. So and then they start thinking logical. Oh, okay, this start because we have these in the cell, the cell express and then that leads to this response. So this is how we try to explain to them.

Frederick: So I want to ask about how you put thoughts together and ideas and how you find mysteries that you want to unravel, but before we get to that idea tell us a little bit about some of the equipment you have in the lab. What are some of the machines? What are the some of the things that you work with every day? So that our listeners can get a sense of what you're doing from moment to moment. What kind of equipment is out there to help you unravel these mysteries?

Farizatto: Okay, so to understand and to see how cells work we need to analyze things microscopically. We have a very nice confocal microscope there. This machine we got three years ago and have helping us a lot about our research there. We can analyze how proteins, for example, are expressed and in specific the brain region. So it's very amazing because we can have a quantitation of that. We can make a qualitative results about that. So it's very important for our research.

Frederick: So you're looking at brain level pieces of intercellular items and then you're using the microscopy to really get a sense of what's different about this life versus another one from this side of the brain versus another one.

Farizatto: Correct. Studying different brain regions. We can have a slice from a brain region from my experimental model using a model of disease or a health model to understand how things work and then we put in a dish. Then after that, we staying with different antibodies that are tagged proteins and then we can quantify proteins. So it's very important because for Alzheimer disease, for example, we have different proteins that are a little bit more functioning. So there we can quantify and see when we have this type of Isolde we have these proteins expression works in this way and then of course, we always compare. We have control tissue. So this is how we measure few things that are doing the disease. Another thing that we use a lot there also to quantify proteins is a Western blotting technique that is very important as well. So scientists around the world also use this and it is very important. We measure how proteins are in our brain. So proteins basically we can measure the function. So if we have an evaluation of a protein you can have a disease, or if you have other regulation of proteins, you can also have a disease.

Frederick: And you can figure this out in part by looking at specific proteins from specific regions and comparing them to a typical or a control group protein and you can see what the similarities or differences are.

Farizatto: Correct. We also do our NEA technique there so we can see transcription of a specific gene and then we can measure and compare with protein levels transcription and then we can have idea how our model is working and how these can be important for a mechanism of disease.

Frederick: So let's talk a little bit about that model and about a kind of a hypothesis. So scientists to some extent have a hypothesis. They have an idea they want to test it. They use their equipment to gather the data and then they try to see if they can find a specific pattern and then you have to go back and replicate it to make sure that all the steps you previously did right. That's got to be a little frustrating.

Farizatto: Oh yes, this is one thing that we teach his students because when they getting the lab and they started doing the procedures or experiments and collecting data. Then you pull the data and then you see the result. Now they realize how things are complex, how things that are not simple for you. Starting with a hypothesis, idea, and then you finally have your answer. And not necessarily the answer is what you expected. So most of the time is not exactly what you expected. So this is one thing and this is why science is so exciting because when you test one hypothesis you ended up having a lot of questions in your mind and then you have much more ideas having an answer that you were expecting or not. So you say oh, so this is leading to that, so we may inspect more this pathway because this could explain better our hypothesis, not what we were thinking, so stuff like that is very exciting.

Frederick: And so for researchers in all fields, sometimes the answer is not really what you're spending most of the time looking for. You're looking for the right question and every hypothesis leads you to determining not just what the answer is, but did I ask the right question and so over time you narrow down to a question that might really eventually lead to an answer.

Farizatto: Correct. So I read about people discovered a compound that could treat a type of disease by a mistake in the lab. So using our own concentration and they said oh my goodness this concentration supposed to meet him he bit this pathway and then they found about a less concentration is not inhibiting, but is activating and then this starting no one new theory about how this compound could work.

Frederick: So part of why you have to be so rigorous in your note taking and in your lab reporting, and to documenting every step is that when a mistake is made you want to 1) know what that mistake is and when it happened but 2) that mistake could open up really a better question or potentially lead you to a more complex answer.

Farizatto: Correct. Science is about a hypothesis, ideas, and testing these ideas, of course with a basic background. So yes, so successful theories was made from mistakes made in the lab. This is why we also tell our students, oh, no worries. So this is important. You need to understand. You need to learn. Now you have a new output for you. So just let's do next time.

Robin Cummings: This is Chancellor Robin Cummings and I want to thank you for listening to 30 Brave Minutes. Our faculty and students provide expertise, energy, and passion, driving our region forward. Our commitment to southeastern North Carolina has never been stronger through

our teaching, our research, and our community outreach. I want to encourage you to consider making a tax-deductible contribution to the College of Arts and Sciences at the University of North Carolina at Pembroke. With your help we will continue our impact for generations to come. You can donate online at uncp.edu/give. Thanks again for listening. Now back to more 30 Brave Minutes.

Frederick: Well, you mentioned a fair number of terms and so maybe we should sort of clean some of them up. Alzheimer, degeneration, dementia is somewhere in there. One in ten Americans under the age of sixty-five suffers from Alzheimer's disease and about 48 million more worldwide suffer from one form of dementia or another. What is Alzheimer's disease? What do we know about it? And what is the difference between Alzheimer's and dementia?

Farizatto: Okay. So let's answer your last point. So dementia is the symptoms. So Alzheimer is a disease, not necessarily because elderly people start thinking that oh, I have episodes that I'm forgetting things and they started getting worried. So this is not necessarily you going to develop a disease, so,

Frederick: Lots of people can have dementia but not have Alzheimer.

Farizatto: Correct.

Frederick: But everyone who has Alzheimer probably has some form of dementia.

Farizatto: Perfect point. So this is the point: dementia not necessarily leads to the disease, but everybody that has Alzheimer disease will have dementia. It's so dramatic how the incidence of Alzheimer right now. The people who started saying why this type of diseases affecting too many peoples now? The answer is because people are living more so disease that used to kill people like heart attack or stroke or cancers so that research is very clear right now. So we have a lot of approach that can treat or prevent this type of disease, but not the same thing with Alzheimer. So this is why we have we are seeing more people every day developing and being diagnosed with Alzheimer.

Frederick: So it's like what we were saying earlier about questions. As we solve, finding answers to some questions and people start to live longer, we also find new questions to attack. The longer people live, statistically, perhaps, maybe the more likely it is for them to get Alzheimer's?

Farizatto: Yes. This is the point, because only 10 to 5 percent is related with genetic factor. So 90% to 95% of people that develop Alzheimer disease is related with aging. So now the first patient that was diagnosed with Alzheimer was in 1901. Then we pass more than 100 years and now we are starting understanding a little bit more about what causes Alzheimer because if it is the aging process is the main factor, okay. How aging affect our brain cells? So this is one

important point. Not necessarily all elderly people will develop Alzheimer. Not necessarily everybody that has the hallmark proteins that people hear about a bed of quakes or near febrile are dangos formed by Tau protein will develop Alzheimer. So this is the main point: how and why the aging process is starting effect in a way group of peoples and not on others? So I would like to just add one point. How aging is important factor to develop Alzheimer because at 60 or 65 years old you have a big increase of people developing Alzheimer. At 70 years old, you double the number of people having Alzheimer. At 85 years old you have 65% of elderly people having Alzheimer so this is important point.

Frederick: So a lot of what you guys are doing is you're working on this protein level and Tau proteins and a lot of other things and we'll get to that in a little bit because that's really what we don't know yet exactly about Alzheimer's but let's start with even a more easy question. What do we know? What do we know about Alzheimer's? How people get it? How quickly expands? What do we know?

Farizatto: Okay. So what science know about we are first thing they were thinking okay, neurons are malfunctioning and the communication between neurons is not efficient as used to be in the past and they've locked a drug that helps this neuronal communication. But at the neuronal communication is going with the consequence of something that's happening at the cellular level at our cellular functioning that leads to this malfunction, the bad communication between neurons.

Frederick: So the communication is the thing; the miscommunication is something we notice pretty quickly, but we have to go a little bit deeper to figure out why the miscommunication is actually happening.

Farizatto: Exactly. So now the drugs that we have in the market are treating this miscommunication, but now all scientists is stepping back and say okay, so we need to treat the early onset of the disease.

Frederick: Not the symptoms but the underlying root cause.

Farizatto: Exactly. For you to have a cure you need to treat the onset and now if we know that several proteins are malfunctioning, accumulating. So I like the analogy that my colleague, Dr. Ben Bahr does. We have organelles inside the cells that works as a garbage disposal, so think in your kitchen. So you bring food to your cows and then you put in the kitchen and you process the food there. If you don't get away with all of the trash you start accumulating there, and then if you put a trash on your floor and then the telephone rings in another corner, and then you try to cross your kitchen and then you can't reach as you used to reach if you don't have any things blocking your crossing there or sometimes you can't even cross your kitchen to get the telephone. So this is how things works inside the neural that is developing a degeneration process when you

have Alzheimer. The cell has a garbage disposal inside called lysosomes and then cells for the producing proteins there and then the cell is not doing the clearance and then all this trash is starting accumulating there and then stop all the other factors that we have inside the cell for functioning properly.

Frederick: So at the cellular level we have to be able to get rid of all of the interior waste products. The interior cellular waste products and if we don't it stacks up and then we got all kinds of problems.

Farizatto: Correct. This one main factor is also now is one of the biomarkers for you being diagnosed with Alzheimer or not. But how I said is hard. You just say if you have this high levels of this type of proteins, you're going to have Alzheimer. Not necessarily. So these proteins, of course, they are not accumulation of this protein is the problem but these proteins are there so they make a function inside our neurons they are important there, but then they started you know, malfunctioning and then this leads to the problem. This is the issue.

Frederick: So is it fair to say that not only do we want an adequate supply of the good proteins who can handle some of this we also at the same time what a minimize some of the not so productive proteins that are in the middle of this as well.

Farizatto: Correct. So what do we know related with a genetic factor? We know that the people that develop early onset related with a mutation in a specific gene is related with one of the type of these proteins. That we know okay. So this protein when we have our overexpression, these will lead, will damage the neural end. We will lead to a synaptic-pathology that can cause apoptosis, which is the death of a neuron.

Frederick: And so in one of the pathways you're hoping to continue to explore is the use of natural extracts to treat or prevent some of this synaptic-pathology in the early stages.

Farizatto: Yes. Now we scientists are trying to understand why some people have more probability to develop the Alzheimer disease effect than others. People were starting looking at the incidence of Alzheimer disease in certain populations and why other groups that has more incidence to develop Alzheimer. For example, in Asia and Japan they have less incidence of Alzheimer disease than here in America. So what they do? What is the difference? What is the lifestyle that makes less, decreasing the probability for developing this type of disorder? And then we starting thinking that the environment factors can affect how our body will behave. So one thing that a natural extract, like Native Americans, for example, we always have a grandmother say, okay, if you're sick you can have this tea. A green tea is good for you or ginseng increase your metabolism, stuff like that. So then as the scientists are more interesting in things that can prevent so not lead to the disorder in fact. So we are testing a natural extract that is making a very nice progress for the garbage disposals. So we are using natural extracts,

making this garbage disposals working better. Then, we had a reduction of this pathological protein overexpressed in our model of Alzheimer, and then consequently, we have a better neuronal communication. We have synaptic markers going up, so is working very, very well.

Frederick: So potentially some natural extracts in a reasonable enough concentration or dosage could prevent that accumulation of those waste products or at least allow them to get out of the intercellular problems quicker. Therefore, you minimize the potential of contracting the disease in the first place.

Farizatto: Correct. So we tested in two different ways. We gave to our model of disease a dose before starting having the disease and then we saw a very interesting promising result. So preventing the degrees of many factors, many proteins, that is very important for the keep the neuronal cells healthy. And then, we tested for a model that had established disease and then we gave them and they also showed very interesting results showing that they can repair all the damage that caused.

Frederick: And how exciting for you in all of this fascinating research and these new hypotheses, and testing these results, and analyzing your data, that you're incorporating undergraduate students into so many of these activities. How rewarding is it for you to get a whole new generation of scientists excited?

Farizatto: Yeah, is very excited, so we treat students like our child. So when we see them developing tasks, some new skills, they develop the curiosity side of them. They are very proud to make part of this team. Oh, yes, we are using a drug that can potentially treat Alzheimer disease and they get excited all the process and of course, they also present data. So they do all the experimental process. They collected the data, they plot the data and they are able to present this results for all the public. So they are very excited there and we are very proud to be part of this process.

Frederick: And how rewarding for you to be able to think about one day 20 or 30 years from now, scientists will be interviewed for a podcast just like this and they'll say, how did you get your start in science and they might say, well when I was an undergraduate, I got to work with Karen Farizatto and she showed me some of these scientific techniques, back when we were working on Alzheimer disease and really got me hooked on being a scientist for the rest of my life.

Farizatto: That's true. It's so exciting because now I'm getting touch with more and more students. Now, I'm mentoring my own students. Of course I'm very proud to be part of Dr. Bahr's lab and UNCP. Now we see more students because we can see them developing and moving forward their careers. So we have students now on the graduate school, we have students joining army research. So is very nice. So we're thinking we are getting old as well. So the people are

asking okay can I have a reference letter from you and say yes. So I was thinking that they will be network in the future. So I was thinking okay that student is at NC State or that student is in Tennessee, so they will be my future network for sure. I hope, yeah I'm looking forward to working with then again.

Frederick: Well, we're running out of time, but I want to ask you one last question before we go. What do you see as the future of science? How do you think 20 years from now researchers will be working? What kinds of questions will they be tackling?

Farizatto: Okay. This is not a simple question to answer, but I think science change as the world is changing, so we will see things being remake, progressing and I think the future is very exciting. So I remember when we see that movie Back to the Future so they were thinking that in 2000 we were using cars flying.

Frederick: I'm still waiting for that! When is that going to happen?

Farizatto: So, we always think that the future will be all technology. I don't know if we going to have the cars flying instead of using the road, but I'm pretty sure we will make a lot of progress.

Frederick: And maybe somewhere in southeastern North Carolina right now there is a young girl learning about science and one day she will go to Brazil and spend part of her career there working on interesting questions just like you coming from Brazil.

Farizatto: Amazing. Thank you very much. It was a pleasure.

Frederick: Thank you for sharing your research. It was great spending this time together. Thanks to everyone for listening. Join us next time for 30 Brave Minutes.