Avery Martin: Welcome to Health and Human Science Matters, a podcast by Colorado State University's College of Health and Human Sciences. I'm Avery Martin, co-host and digital media strategist.

Matt Hickey: And I'm Matt Hickey, associate dean for research and graduate studies. In our college, we make it our mission to optimize human health and wellbeing through discovery and innovation. But don't just take our word for it. Each episode, we sit down with people who fulfill that mission, our college faculty and staff.

Avery Martin: Today we're speaking with Dr. Sarah A. Johnson registered dietician, nutritionist, associate professor, and director of the Functional Foods and Human Health Lab in the Department of Food Science and Human Nutrition at Colorado State University.

Matt Hickey: Sarah, welcome.

Dr. Sarah A. Jo...: Thank you. Thank you for having me.

Matt Hickey: Well, we're looking forward to it. We always want to get to know people across the college in a couple of different ways. So we're going to talk about Sarah, the scholar, and Sarah, the mom and wife, and all the things that you're interested in that occupy your time when you're not on campus. But we'll start here because we happen to be sitting on campus, and so we're always interested in big ideas.

So if you were to describe to a listener what sort of big problems or questions you pursue in your lab and with your collaborators, what would that be?

Dr. Sarah A. Jo...: So in the Functional Foods and Human Health Laboratory, the research direction that we take is we want to do translational research that spans agriculture all the way to human and public health with the goal of improving human health and promoting healthy aging. We have an increasing population. We have increased chronic disease risk. We have increased life expectancy, right? And we don't just want to increase life expectancy, but we want to improve health span, how many healthy years somebody has during that life expectancy so that they can fulfill the best, happiest life possible.

And I'm particularly interested in chronic diseases associated with aging and menopause, which is a part of aging, but particularly cardiovascular disease and cardiometabolic disease more broadly, which could include Type 2 diabetes and pre-diabetes, high blood pressure, obesity and overweight and attenuating chronic disease risk factors that are associated with cardiometabolic disease with aging, so that we can reduce disease risk. That's the big problem that we hope to address.

Matt Hickey: Tell our listeners what you mean when you use the term functional foods.

Dr. Sarah A. Jo...: So functional foods are a term, it's not defined by the Food and Drug Administration, so they're not regulated by the FDA, but functional foods are basically foods that provide some additional health benefit beyond meeting our basic nutrition needs. So traditionally and historically, nutrition science was predominantly focused on diseases associated with nutritional deficiencies. So if you didn't consume vitamin C, you could develop scurvy, or if you don't have enough vitamin D when you're growing up, you can have rickets, which is a malformation in bone development in children.

And so that was more focused around how can we prevent these nutrient related deficiencies and associated disease risks. But accumulating research over the past several decades has identified phytochemicals, which are naturally occurring plant chemicals that can also be referred to as phytonutrients or bioactive compounds, bioactive food components. They have various names, but these plant chemicals, for example, blueberries have compounds called anthocyanins, which are responsible for the bluish, purplish color of blueberries, but they also provide additional health benefits in the body.

And so that's not something that you would see necessarily on a nutrition facts label like you would vitamin C or vitamin D or other nutrients. But we, as researchers and practitioners, we know that these compounds have additional health benefits and they can function in the body at the cellular, molecular, tissue level. They can have various functions that are protective against disease and promote healthy aging.

And so functional foods are unique and beneficial in that they can be naturally occurring, sort of the basic foods that we eat, like blueberries, whole grains, salmon, some of the typical whole foods, but you can also have modified food products like certain yogurts that might have prebiotic dietary fiber in it and other different types of more processed foods, but processed in a way that's healthful to the body.

Matt Hickey: That's awesome. So tell us a little bit about the genesis of your interest and nutrition in general, and then we can talk about how that sharpened as you moved along through your educational pathway to thinking about bioactive compounds and foods and the fun stuff you're doing now. But walk us back a year or two.

Dr. Sarah A. Jo...: A year or two, not all the way back to high school when that started.

Matt Hickey: As far back as you'd like to for sure.

Dr. Sarah A. Jo...: Well, I can just say that my interest in the food as medicine, food for having functional benefits actually started in high school. I was a vegan and a vegetarian off and on for several years in high school, and I remember someone saying, "Hey, you could have some nutritional deficiencies, you might consider multivitamin." And that kind of led me down the path of nutrition and learning more about foods and how can I prevent nutritional deficiencies.

But then I went to undergraduate school in Vermont and started... I was studying environmental science actually, and I'm still very interested in environmental preservation, but I found that my passion really lied in reading about nutrition on the side when I wasn't studying for school, and it was kind of taking over my life a little bit. I also worked at a health food store in their produce department. I worked in their vitamins and supplements department, and I started writing for a newsletter about the health benefits of foods.

Matt Hickey: All as an undergraduate.

Dr. Sarah A. Jo...: As an undergraduate student. It's a long story, but I'll cut it short. And basically after talking with some professors and my family and various people, ultimately decided to change my major to nutrition, extend my graduation to six years and pursue nutrition, and it's been my passion ever since.

Matt Hickey: Good for you. Now, where did you get your undergraduate degree?

Dr. Sarah A. Jo...: In the University of Vermont.

Matt Hickey: Great. Beautiful downtown [inaudible 00:06:53]

Dr. Sarah A. Jo...: In Burlington, Vermont. Yes, very, very beautiful. Too cold.

Dr. Sarah A. Jo...: True. I won't argue with that.

Avery Martin: Did you grow up on the East Coast?

Dr. Sarah A. Jo...: I grew up in Florida.

Avery Martin: So the east, but not northeast then.

Dr. Sarah A. Jo...: Correct. The southeast. It's very different climate. So that's really where it started. And then moving into graduate school, I continued my path studying nutrition and dietetics. I pursued the registered dietician nutritionist credential and really wanted to work with patients and clients. Then once I started working as a dietician with patients and clients, particularly in oncology nutrition or cancer nutrition.

Because of my love for my patients and just my passion for cancer prevention and cancer patients and cancer survival, that really sent me down the path of how can I best help my patients and most effectively help them, which kind of led me more down the path of prevention. How can we stop this to begin with? And I just really dove into the food as medicine kind of thought process and approach, and particularly functional foods and bioactive compounds.

Matt Hickey: Let me ask you, as an undergraduate, was grad school always on your mind, or again, was this a sort of a family or a mentor influence that said, "Hey, there are opportunities to continue to learn and pursue your interests?"

Dr. Sarah A. Jo...: So my father actually has his PhD. It's in meteorology. But when I was growing up, he would often be having a meeting to talk about a grant proposal or something that he was doing that sounded really important. And so I kind of grew up like, what is he doing? It just sounds like super important, and I knew that I wanted to become an expert in something. And so I think I always knew that I wanted to go to graduate school.

I did not know at the time necessarily that I wanted to get a PhD. I thought maybe I'd get it later, but I went down the path a little bit sooner.

Matt Hickey: Nothing wrong with that, right? So where'd you go to graduate school?

Dr. Sarah A. Jo...: So I did my master of science degree at Florida State University.

Avery Martin: Back to Florida then.

Dr. Sarah A. Jo...: And I also stayed there for my PhD as well,

Avery Martin: And who did you work with for your PhD?

Dr. Sarah A. Jo...: For my PhD, I worked with Dr. [foreign language 00:09:21]

Avery Martin: And the work you did as a PhD student?

Dr. Sarah A. Jo...: He's one of the individuals that opened my eyes to functional foods research. I'll take a step back and say that actually when I was considering going back for my PhD, I was really immersed in the cancer prevention field and really digging into that research. And there was someone who was a director of a cancer prevention nutrition related program at the NIH. I knew that he was very reputable in the field, an established leader, really a thought leader, and he was somebody that I really looked up to.

And so I actually went to the NIH and met with him one time when I was there. I wanted to meet him, and I actually sought his advice. I talked to him a little bit about what I wanted to do and what I was thinking, and he really encouraged me to pursue my PhD and pursue it at Florida State with Dr. [inaudible 00:10:21]. And it was a little bit of a different path because I knew that if I worked with this mentor, that I wasn't going to necessarily be studying cancer prevention directly, but the totality of his expertise and the program and just all of the factors that led me to work with him, it felt right.

And Dr. Milner really encouraged me to pursue that. He unfortunately passed away a few years later, but I'm really honored to have had that meeting with him and to have his inspiration.

Matt Hickey: Smart investment of time, for sure. So the functional foods that you began to work with as a PhD student?

Dr. Sarah A. Jo...: So Dr. [foreign language 00:11:03] has worked with several functional foods in his career, and when I initially started working with him, there was some research going on with berries, a potential blueberry study, some strawberry research. We also had some research going on with soy and vitamin E and other functional foods as well. But I've always been particularly interested in berries and especially blueberries, and so...

Matt Hickey: I'm interested in blueberries.

Dr. Sarah A. Jo...: Became an opportunity for me to pursue some blueberry related research, and I immediately jumped on that. I'm so glad that I did.

Avery Martin: So the qualities that piqued your interest in blueberries, was it just because you liked blueberries or was it because of the characteristics and the potential health effects that they had or both?

Dr. Sarah A. Jo...: Both. So I've always been drawn to really colorful foods and blueberries have that beautiful blue color. And so that's one aspect and just thinking about phytochemicals. Phytochemicals are often present in the highest quantities in some of the most vibrantly colored foods. But I will also take a step back and make a note that garlic and onions and things that are not super colorful also have phytochemicals and are very, very good for you. So I just want to make that statement before I move on.

So that's one reason. But really blueberries, they're probably one of, if not the most researched berry type, and particularly in the area of cancer prevention. I was familiar with a lot of the cancer related research. And so as soon as that opportunity was there, I knew that that's where I needed to go because I was aware of promise in terms of research, and they have these beneficial cancer protective effects.

And the likelihood of them also exerting additional health benefits is very high because the pathophysiology of cancer and cardiovascular disease and other diseases, it's not the same, but some of the underlying factors and mechanisms overlap.

Avery Martin: That's great.

Matt Hickey: For our listeners, again, I want to ask you to cast a little vision about even within what might be perceived as a "narrow disciplinary focus of sort of functional foods or phytonutrients." There's actually a range of scholarly opportunities that you can pursue from the basic science of structure and function of particular molecules. And what they interact with inside a cell, these sorts of things to the more applied into the spectrum of what happens to either human or animal health when I'm providing supplemental forms of A or B or C.

And so could you give our listeners a little bit of a sense of that spectrum and where your own research fits, maybe have your feet in both ends of the spectrum?

Dr. Sarah A. Jo...: So in the broad area of functional foods, as you mentioned. I mean, an individual could do research at the food level and related to food product development. An individual could also do research related to characterization of those phytochemicals that are present in foods and really understanding their structural and chemical properties and potential benefits. Individuals can also work at the cellular level doing cell culture studies with foods and food components.

That gets a little bit more complicated because when you think about human consumption, you have digestion, absorption, metabolism, you have all of these processes that take place before the compound or its byproduct can have an effect. And with the case of phytochemicals, a lot of those compounds are transformed. They're transformed into what we call metabolites of sort of the parent compound that someone might ingest. And so the functional properties will change as the chemical compounds change in the body.

That doesn't mean that they don't have beneficial effects, they just have different effects. And so with cell studies, it's really important to take that into consideration and to design studies properly. Then we have human research, which is one of the major areas that we work in. And human intervention studies are beneficial because you can, if you are able to demonstrate an effect in a human randomized controlled trial, which is the gold standard of doing research, that's really powerful. Because here we're working with individuals that have their own lives, they have their own diets, and it's messy.

And so it's a little bit more difficult to show an effect. And so when I see beneficial effects in humans, I'm really excited about that because you can't always demonstrate that. And so there's the human intervention research piece, and then you can also take it into the community and the public health level, which is an area that I'm starting to move into as well. And that gets into the community. So now you're almost removing people from the clinical laboratory setting and going into the free living environment, which is even messier.

And so that'll be interesting for me to navigate as I move into that area. But within our lab, we do what I would consider to be clinical and translational research. So at sort of the core, and I'm a registered dietician nutritionist and RDN, and I want to do research that's going to have the greatest impact on people, something that people will actually do that's feasible, that's affordable, that's relevant, that's achievable for individuals to do with in their life.

And we pursue clinical and translational research. So at the core, doing these randomized controlled trials, human intervention studies, but I don't want to just do research where it's like, "Hey, let's see if this food has this effect in the body." I want to understand the how and the why, and I also want to understand what can we do before we get to the food product that might actually help enhance some of the health benefits. And so we do translational research all the way from agriculture and food science.

And this is through collaborative research projects. I'm very multidisciplinary in my approach and in the approach of our laboratory. So we collaborate with people in horticulture, agricultural sciences, and food science, in dietetics and nutrition, all the way to physiology and biomedical sciences. And now, as I mentioned, moving into the public health and community space as well. In our approach, it's really important to consider how research will translate from one piece to the next. Because along the continuum, you can't design research without thinking about how changing or doing one thing might affect the next study.

So if I'm doing something in a food or agricultural product, I can't just, let's say, increase the levels of phytochemicals and just make the assumption that increasing the quantity of phytochemicals in a food product is going to mean increased health benefits or increased absorption in the body, let's say, of the compounds, the phytochemicals or their metabolites. So you really have to take it along that continuum to ensure.

And so we try to do translational studies where we take a food product, we might modify that food product, and then we'll look at maybe certain nutrients and phytochemical compounds and quantities within that food. But then maybe we need to translate to a cell model where we can look at how well are those compounds absorbed, let's say, in a model of the gastrointestinal tract. And that's really interesting and informative, but now we have to take it a step further, and that could either be in an animal model or in a human study, for example.

But cell research may not translate to humans, and so it can provide important information that we need along the way. But the ultimate goal is to establish that effect in humans. And then beyond that, beyond just showing a clinical benefit, now in the real world, are people going to do this? Can they do it? Will they do it? Why or why not? All of these things we need to be thinking about.

Matt Hickey: It's simultaneously daunting and fascinating in some ways, isn't it? One of the things I love as I listen, is there are elements of what you do know that touch where you started at UVM as an undergrad. The environmental piece in this case is the agriculture, and we can think about access to water or sunlight or soil chemistry, all these different things that can contribute to a soybean or a blueberry not being a soybean or a blueberry universally because of the conditions in which they're grown.

And so even that is not so simple. I've got a wild blue, well, where did it come from? And what are the environmental conditions? And so the phytonutrient chemistry might not be identical based on where you find them, which is another layer of what I find to be really cool stuff, but challenging when we're talking about translation into human health.

Dr. Sarah A. Jo...: Absolutely. I mean something as simple as where foods are grown, how they're grown, in what conditions, whether they're grown outside in soil or they're grown in a controlled indoor agricultural environment. The effects of global climate change are having impacts, there's so many different factors, and it's messy. That's another aspect that makes it messy, but that's the real world, and we have to dig into the messy thing to understand the true effects.

Matt Hickey: Hear, hear. So you completed your PhD at Florida State, and then what?

Dr. Sarah A. Jo...: So I completed my PhD, and I had amazing opportunities during my PhD. Coming back to that, listening to my dad, having those meetings and phone calls about grant writing. I'm like, "I want to write grants." And so it's something that I actually enjoy and I'm pretty good at, I think. And during my PhD, I had amazing opportunities to write research proposals with my mentor. The more I wrote, the better I got at it.

And then it turned into, "Hey, it looks like we might be able to support you as a postdoc with this funding." And so we were writing grants where I was co-PI and co-investigator and so I had grants under my belt that I helped to get, and then I stayed there as a postdoc and ran those studies.

Matt Hickey: And there's a lovely little lesson in it that I'm going to draw out for all listeners. Again, the more I wrote, the better I got. That's a keeper, for sure.

Dr. Sarah A. Jo...: That's still true today [inaudible 00:22:00] continue to get better,

Matt Hickey: How often you do it, right? There's always skills that can be improved, for sure. When were we lucky enough to bait the hook and get you to come join us at Colorado State University?

Dr. Sarah A. Jo...: So there was a little bit of fate involved in that, I'll say or something. So my brother and husband were actually talking about wanting to move to Colorado, and I had actually said prior to that that I would never move anywhere cold again after I left Vermont. Never say never. The more they kept talking about it, I was like, "Okay, let me just go and look and see what's available."

And I actually came across a job posting for an assistant professor in the Department of Food Science and Human Nutrition at CSU, and they were looking for someone who specialized in functional foods.

Matt Hickey: How do you like that?

Dr. Sarah A. Jo...: Right. It was perfect, right? The only problem was that it was an old job posting and not that old, but it was in the past. So I actually emailed the previous department head Mike [inaudible 00:23:08] and asked if for any possible reason, is this opportunity still available? And he informed me that they had a search that did not go well, so they did not hire somebody and they were going to be reopening the position and that he would send it to me, which he did. It's amazing.

Several months later, he sent it back to me via email, and I don't know, it just all fell into place.

Avery Martin: It was meant to be.

Dr. Sarah A. Jo...: It was meant to be. It was perfect. I mean, once I saw that job posting, I knew that was the job for me. I looked into the department, into the college, into the university, the surrounding institutions. I mean, I don't think I could have found a place better for me than here.

Avery Martin: [inaudible 00:23:51] an environment, isn't it? So how long have you been with us?

Dr. Sarah A. Jo...: I've been here for about eight and a half years, and I'm now an associate professor.

Avery Martin: Congratulations.

Dr. Sarah A. Jo...: Thanks.

Avery Martin: Indeed.

Matt Hickey: And so if you were to take us into Sarah's functional food lab.

Avery Martin: We always sort of hesitate to ask this question because we understand there is no typical day. I think your messiness comments have hinted at that, but a day in the life of you and your team, what might be a representative example of life in the lab?

Dr. Sarah A. Jo...: It's definitely different from day to day, but we have a few different clinical studies going on. So any given day, we might have some clinical research visits in the laboratory where we have our human participants coming in and we're collecting various measurements on them, blood pressure and cardiovascular measurements, drawing blood and going through questionnaires and things like that. And then we have biological sample processing that goes on with that.

We collect various samples like blood, and I'll probably stop there. So typically we have these clinical research study visits that are going on and underway. I have a great team in my research. There's multiple students and/or staff members that are working on the visits. And then depending on the procedures, some of my students will do some of the measurements or procedures for certain measurements and procedures. I'll come in and do that. And then we also have sample processing. We have to enter data, and we really try to keep our research as rigorous as possible.

So we do double data entry with a third person to review it. And so there's constantly research going on in our lab, but the point is not to torture my students with double data entry, but just to make sure that the data are accurate. And so we have all of those things going on, plus the typical classes and milestones that students are going through, thesis projects, dissertations, dissertation proposals, dissertation seminars and various things plus grant writing. And I like to involve my students in that.

And so I'm training my current PhD students to write grant proposals. So we've been pretty busy, but I think highly productive.

Avery Martin: I would say so.

Matt Hickey: For sure. Now, when you're prepping for a particular nutritional intervention, again, I think our listeners would be curious, are your students walking past seven or 8 55 gallon drums full of blueberries? Sometimes it's an extract of, again, the natural product, right? So talk to us a little bit about when we're feeding somebody, what does that look like?

Dr. Sarah A. Jo...: So we do double-blind studies when we can. So a double-blind clinical study is where the participants don't know what they're consuming, whether it's a treatment or a placebo. And we as investigators and staff also don't know what they're taking. And so with some of our blueberry intervention studies, we actually use a freeze-dried blueberry powder. The nutritional properties are not much different, if at all. It's one of the few processes that preserves most of the nutrients, but it's a freeze-dried powder.

So we're able to package that in opaque packaging and then have a placebo powder that looks and smells and tastes very similar to the treatment. And so we pre-packaged those, and then we provide our participants with what they need to consume on a daily basis. And we give them shaker bottles and they mix it with water, for example, and might drink that at home. We also do research with microgreens, and those are a fresh food, and they're not sprouts. They're not baby greens, they're kind of somewhere in the middle.

But that becomes a little bit more challenging to do a double-blind study, at least for now. People consume microgreens fresh or in a prepared food. And so with this, we're taking a little bit of a different approach to how we're doing it, and we're providing those microgreens as fresh foods. And so that's a little bit different. We have to provide them with the food more often because it's more perishable.

And we also, at least for our microgreens research, I collaborate with Josh Craver and the Department of Horticulture and Landscape Architecture and through that collaboration, we grow and use those to feed our human participants.

Matt Hickey: Nice. So some of our listeners will be curious about whether you practice what you preach. So what's not just your diet, but life often... Do you read these practices into your own behaviors for you and your family? But the broader pictures, again, what does Sarah do that's fun that doesn't have anything to do with being a PI and a mentor and a faculty colleague?

Dr. Sarah A. Jo...: So I think a little bit, a few questions there, but I definitely... One aspect that I like about functional foods research is that... And functional foods generally is that they're an addition to the diet. It's not necessarily me saying you have to remove all of these things from your diet. But one of my, I guess philosophies is if you eat more of the better things and you incorporate more of those, even if it's one food at a time, you'll somewhat naturally remove maybe some of the less healthful foods from your diet, if that makes sense.

And so absolutely, we incorporate functional foods, and I have everybody in my family eating blueberries and all of the foods that we do research on, with the exception, as I mentioned to you outside of this, is my daughter, my two and a half year old. She is refusing some of those foods right now. But we're doing our best to incorporate all of these foods into my diet, but also my family. It's not just about me. And that's the same for our human participants. They go home and eat meals with their families as well.

And so as we kind of think about translating to the community in public health setting, we have to think beyond just that one participant. It's about the bigger picture and bringing the entire family maybe, and even some friends into the picture, because I think that people might be more willing to accept new foods in their diet if other people in their household are also doing that. Aside from that, so do I practice what I preach? I'm getting a lot better as far as sort of the work-life balance aspect goes.

And I mentor students and colleagues and staff, and I can't make people take that work-life balance and prioritize their health and wellbeing but I try. And I am doing a lot better at modeling that myself, especially since the birth of my daughter. I just have to think about things. And I love my research and I love my job, but it doesn't have to be one or the other. And can they be integrated together in some ways? For example, if I move into the community setting and do research, how can I do research in a community that my family could be a part of?

Right? Integrate ourselves into that community. And so those are things that I try to think about, and it's not just about the research. It's how can we be happy and enjoy the community together in various different communities and go to social events that have nothing to do with food and nutrition and enjoy ourselves, but also still be working towards the betterment of human health and happiness.

Avery Martin: That's beautiful. Right on.

Dr. Sarah A. Jo...: Thank you.

Matt Hickey: So when you think about legacy, you've talked about your dad's modeling of behaviors that appeal to you, and of course you've talked about really, I think a bold and courageous step to talk to somebody. Often students will say NIH and think if they've heard anything about it. It's an ivory tower in many ways. And you were willing to go and seek counsel, which has had an enduring impact on you.

You've referred to your PhD program, your PhD mentor, and those really special opportunities to be involved in grant writing at a relatively early stage. You think about the legacy you hope to leave for your trainees. How would you describe that?

Dr. Sarah A. Jo...: I've been thinking a lot about legacy lately. My PhD mentor is actually getting ready to retire this year, which I'm happy about. And I think that for him, his legacy is his students and his trainees and the people that are doing work and having that impact. And I know for me, that's going to be a huge legacy. And that's one of my favorite aspects about my job is mentoring and training the next generation of scientists and practitioners and industry workers and whatever field they want to go into.

I truly love mentoring. So as long as I can make an important impact on the lives of my mentees and their career trajectories and their happiness, I think that will a huge legacy for me. Just knowing that I was an inspiration or helped someone navigate to figure out where they are best meant to be or to help them find their love for research, or to be a dietician, and not doing research necessarily, but they can read research studies and they can think about dietetics and research in a different way. I think that's truly my legacy.

Matt Hickey: I think that's great. Well, thank you for being willing to spend some time with us and sharing your tales of Florida and Vermont and Colorado and everywhere in between. We really appreciate that.

Dr. Sarah A. Jo...: You're welcome. Thank you for having me.

Matt Hickey: It's good a one.

Avery Martin: And that's the show. Thank you for listening to another episode of Health and Human Science Matters. If you want to learn more about our College of Health and Human Sciences, go to www.chhs.colostate.edu.

Matt Hickey: And if you haven't already, add Health and Human Science Matters to your library of podcasts, give us a rating and leave a review.