PODCAST 38: Mysteries of the Human Body

Narrator & Editor Dr. Richard Gay: Hello and welcome to 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. You can easily receive our new episodes by subscribing to our program on iTunes and Podbean. The topic for today is the mysteries of the human body. In this episode the dean of the College of Arts and Sciences, Jeff Frederick is joined by Dr. Courtney Carroll, and Dr. Crystal Walline from the UNCP Department of Biology, and Dr. Todd Telemeco founding dean of the UNCP College of Health Sciences. Get ready for 3o Brave Minutes.

College of Arts & Sciences Dean Jeff Frederick, host and narrator: Across the landscape of facts that may come in handy at the next cocktail party or when watching Jeopardy are any number of items about the uniqueness of the human body. Blood, for example, probably makes up about 8%, give or take of the total body weight, skin probably accounts for about 15%. Eye muscles can fire faster than most any other human muscle. A human heart beats about 3 billion times over the course of a typical life. Your nose may be able to detect a trillion different smells. Bone marrow and hair grow faster than most anything else in your body and your small intestine unwrapped might be about 23 feet long. And here's one that I'm not sure what to do with. If all of the saliva your body produced in a lifetime was captured, it could fill a couple of swimming pools. Useful information? Maybe not, but it does open up a lens into the mysteries of the human body. In some sense, I wonder how much we really know about the body. New innovations and academic research, medicine, equipment and imaging have unlocked some fascinating new features and benefits of the body, but for each new piece of the code we crack, it opens up a new mystery. Maybe it's sort of like being in one of those escape rooms with a bunch of friends and you're trying desperately to unlock the mysteries one at a time to find enough clues to get out. But with each new clue you uncover you have a new riddle to solve. Life expectancy a hundred years ago was in the late 40s or early 50s for the typical American. Any number of reasons accounted for this: dangerous and demanding physical jobs in agriculture or industry, transportation challenges, which prevented many Americans from receiving primary, behavioral, or therapeutic care, even if they could afford it, and pregnancy and birth control realities. In a comparative posit of medical schools, hospitals, and other training and care facilities. It's also true that a hundred years ago we didn't have electroencephalograms, arthroscopic surgery, dialysis, ultrasound, prenatal vitamins, much in the way of antibiotics, or much of the way of transplantable organs or prosthetic limbs. Academic and medical research helps us learn something new about the body all the time. Primary care providers use this information to develop new theories or modalities of care, and then durable medical equipment companies, researchers, and pharmaceutical companies develop prototypes and products to implement these new ideas. Finally, if all goes well, we impact the patient and sleep well, knowing something good came out of the end process. When it works right, the process unlocks a mystery of the human body or helps us to get something out of the way that's preventing the body from helping or healing itself. Joining us today to talk about the mysteries of the body are Courtney Carroll, Crystal Walline, and Todd Telemeco. Welcome.

Walline, Carroll, and Telemeco: Thank you for having us. Hi. Thanks.

Frederick: So how did each of you get started studying the body? Tell us your own story and which elements of the body and how they work have been most interesting to you.

College of Health Sciences Dean Todd Telemeco: Let's see. So I got started in the body probably after I was in college and my youngest brother was hit by a car. And in that process of being hit by a car, he had an external fixator and it became my job to turn the screws on the fixator, so maybe it was a little sadistic. But, I became curious about the healing process and how metal interacts with the bone and I was curious how the body responds after a hole is put in it, a drill goes through it and a screw gets turned over and over again. I started getting interested in that. As a consequence and I went to physical therapy school because I got into the idea of healing and helping people recover and then while at PT school, I discovered anatomy for the first time, gross anatomy, and got a PhD in Anatomy because all of a sudden, the body and its beauty and its wonder were opened up to me in a lab, and I started thinking about how one thing relates to another and how, when you study the body you might learn by systems, initially: musculoskeletal, osteology, things like that, and neurology. But I was more in the macro anatomy and how one joint affected another joint when I moved it and I just became fascinated with it at that time. So I continued to get a PhD and then I taught it for like 16 years.

Frederick: And your brother survived the care that you provided him.

Telemeco: I was hoping he wouldn't at the time, but he did. Yeah, I know, but I think also in that experience, you know, that's where the health practitioner came out, right? In how the body healing affects growth and development. My youngest brother had growth plates and so he had long-term effects from his injury. And so I began to think about how that process happened. So it also not only opened my interest in the human body, but as a healthcare practitioner.

Frederick: How about the rest of you all?

Assistant Professor Dr. Courtney Carroll: Yeah, so I also got interested from a disease perspective. When I was in I would say middle school my grandmother was diagnosed with Alzheimer's and at the time and still to this day there really wasn't much that they could do. You know, we tried to take care of her the best we could but I became interested in what was happening to her at a cellular level, what was happening inside her brain. So when I went to undergrad I majored in Biochemistry and was really looking at the proteins and those interactions and then I went from there and got a PhD in neuroscience and have spent the rest of my research career really looking at aging neurons and what happens to these cells as we get older, as we face disease insults and other stressors and how we can prevent some of those age-related and disease related decline.

Assistant Professor Dr. Crystal Walline: I don't have a really like, little story. Mine's a little bit different. I like to tell my students that I accidentally became a biologist and I mean that quite literally. I had no intention of ever becoming a biologist. I picked my undergrad because I wanted to be a music major and decided I didn't want to be a starving artist. So I got interested in psychology and majored in experimental psychology. I decided to do a Chem minor for fun because that's just the kind of person I am, and one of my psych Professor was like, "Hey, you're really smart. You should go to graduate school." And when I started to think about what I wanted to do, I wanted to do something that could by psych and chemistry together. So, I applied to neuroscience programs and was admitted and did my PhD in molecular pharmacology with a specialization in neuroscience and all my research was like, in a dish with cells over and over and over and over again. The same experiments with cells and I decided I wanted to do something a little bit, you know, more directly related to like, you know, bedside care. Not just working in a dish with cells. I wanted to at least work in like a model organism or....

Frederick: As exciting as the dish was...

Walline: Yeah, you know, I wanted like a whole like, you know, animal to work with. So I decided to do my postdoctoral research in Immunology and that's how I really got interested in studying the human body and studying how the immune system works and then I eventually became trained in biology in a really long, convoluted way.

Telemeco: I think its funny how your experience started from a micro level; you wanted to work up, and mine started at a macro level and down from function, because I started as a physical therapist and then got a PhD. in anatomy. And my PhD was in cellular biology, so I wanted to go all the way down to the cell into a petri dish and look at microsystems and just see how they function. So it's interesting how we all come to the body and from different perspectives and approach it in different ways.

Frederick: I think there's a book for the three of you to write together with your experiences at different levels. So talk about something that's really interesting and fascinating about the human body. What remarkable characteristic about some measure of it are things that lay folks like me wouldn't know?

Telemeco: I think, for me, as an anatomist I teach gross anatomy, cadaveric anatomy and dissection and I don't think there's a year has gone by with a cadaver that I haven't learned something new. You would think that in the world the body would be put together fairly similarly and it is, but there's so many variations of the same thing, and I never cease to be amazed by, oh, it looks like a new muscle, but someone's already found it. It's occurred somewhere else, but they're rare, and it just amazes me that the beauty of the organism as a whole when you break it down, it is so unique at every level. Even at the macro level, when you see a different muscle or a different range of a blood supply. That's the one that gets students the most - blood supply never looks like we draw it on the board. There's always a variation 1, 2, & 3. What is interesting about that is you think then about healthcare professionals, and I think surgeons most of all, so they're cutting your body up and you're alive and they're supposed to know the normal anatomy, so they don't cut the wrong thing, when about 35% of the time, perhaps, it might be different than they expect. Kudos to them, because I think they have to be experts on a lot of different things, and I'm just always amazed at how those two things interplay with one another.

Carroll: I always like to think about some of the pop signs that you hear about in movies. I don't know the name of this movie, but there was a movie that came out in the past, I would say five years, about people who use "a hundred percent of their brain" Do you know what it was called?

Telemeco: I can't remember. I do remember the movie.

Frederick: Limitless?

Carroll: Something like that and how that the premise of the movie was that normal people, we just use 10% of our brains, but if we could only use a hundred percent of our brains, we would have these like, magical powers. And I always like to explain to my students that if we only use 10% of our brains, then Strokes wouldn't be a big deal, right? Because 90% of the time they would hit one of these, like, filler areas and you would just keep walking and be fine. Yeah, but no, like you use a hundred percent of your brain, which is why brain injuries and all of that is detrimental. So yeah pop signs always get me.

Walline: Strangely enough, I actually taught my example that I'm going to talk about on the podcast today in class and it's that the eyeball is immune privileged. So what that means is that it's not accessible to the cells that patrol your body looking for foreign things like bacteria and viruses. There are cells that go around and try to get rid of these bad things or that will get rid of dead cells or dying cells. And within the structure of the eyeball the immune system cells don't have access and you never really think about this unless you're in a situation where you'd like them to have access and the example, I tell my students is: a couple years ago my dad had a retinal detachment. And he, you know, all of a sudden, had visual disturbances and was really disoriented and he started feeling queasy and sick to his stomach and he was just seeing all these weird things and what he was seeing was blood pouring into the inside of his eyeball, kind of like from the inside out. And he was really disappointed to find out that those blood cells were going to be there for a really long time.

Frederick: Now, there's the movie we should make...

Carroll: Much better science...

Walline: Because those immune cells, those macrophages, can't get inside the eye to eat those blood cells and get rid of them and he's complained many times about the snow globe effect that he has every time he moves his head, all of these blood cells get stirred up and he's got blurred vision in that eye. And his doctor told him it would take about six months for them to clear up and I giggled and I told him that he was just telling him what he wanted to hear. It would probably take a lot longer and I gave him an estimate of a couple years and he's two years out and he still has some occasional floaters. So yeah.

Frederick: Well, with all of the challenges that people face with one element or another it's remarkable how resilient the body is. I'm sort of laboring under this impression, and please, correct me, that the body fixes so many things that we don't necessarily even know that's going on. But I am really fascinated by this idea of resilience. Talk about how resilient the organism itself is, in the way it can fix itself.

Telemeco: I think of stroke patients because I think there's a window of opportunity. You know, when you lose brain cells, whether it's hemorrhagic or ischemic, you lost a portion of your brain, but you can still relearn to do things and to me that's just amazing. That despite the fact that in some cases without a large portion my brain I can still function. I can still do these things. It may not look as pretty as we're used to, but the body can recover to the point where I can function day-to-day and I'm still just amazed at that process and how we used to think that window of opportunity was very narrow and we're learning now that it can be elongated and prolonged a little bit, that you get more gains with the right amount of therapies. I look for the future as we begin to even extend that window even further, so we're not limited to a maybe a four month or sorry, a six-week window of recovery, that we actually get longer changes and can really improve function. I just think that's amazing how that happens. I also think about how often do we hurt ourselves? You know, you may trip off a curb. It's not a major issue. But you know, there's some tissue damage just from that little thing but you continue to walk on like there's no problem. You don't lose your balance. You don't fall. There's not a major catastrophe. You just kind of deal with it and your body is just, your brain is able to say, okay, that's just about let me click on this one and keep going like it's nothing and it's just amazing that there's always this threshold that has to occur before we truly as an organism recognize there is a problem here. I'm still fascinated every day by that process.

Walline: One of the things that I think about is how many kind of compensatory mechanisms there are. I guess that bounces a little bit off of what you were saying in that there's a lot of different ways that your body regulates blood pressure. So if, you know, your blood pressure starts to fall because one of those, you know, systems is a little out of balance, there are other mechanisms in place that can compensate to bring your blood pressure back up and like healing is, you know, a great kind of example that, you know, cuts and scrapes and bruises, and all these different things, your body just kind of, like takes care of it on its own and you don't really have to do too much about it. Maybe cover it and keep it clean and you know, your body will pretty much take care of it.

Carroll: Even stressors that we think of as a really big deal. Like, I'm the kind of person, I need to eat like every 3 hours, you know, just for my sanity, but technically your body could go a real long time without food. You think of those people who went on hunger strikes for 21 days. Weeks and you know, but it wasn't great, but their body could keep going, but doesn't need to eat every three hours.

Walline: I remind my cats of that. Yeah, they have subcutaneous fat and they're not there for storage. Yeah, they'll be okay.

Frederick: Please don't tell me what they tell you. (Everyone laughs) A couple of you brought up healing, so I want to talk a little bit about that. If you can describe for us a very simple thing: I fell down and I skinned my knee or my elbow, whichever you want. What does the body start doing? How does that process work from "I got a boo-boo" all the way to the scar is no longer even visible?

Walline: Yeah. I'd love to fill that in for you. So essentially the first thing that's going to happen is that you'll tear or damage the tissue. So let's say you scraped your knee and it's bleeding. You're going to scrape through the skin which has two different layers and in the deeper layer, the dermis that has a good blood supply. So when you tear that tissue, you're also going to be tearing that blood supply. The bleeding will cause a blood clot to form and we call that a hematoma or you can call it a blood clot and then after that the body will go in and try to patch the wound. It's really good patching wounds very quickly with connective tissue.

Frederick: Is the brain kind of directing all this or does this just involuntarily happen?

Telemeco: It's involuntary but it is still dictated by your brain and chemicals and you have the autonomic nervous system responding to that injury. And at first it says, okay, let's dump some blood here. Okay, that's enough. Let's cut that off. It's just so precise and you don't even think about it. You just don't think about it, but all these intricate little events are happening at the same time telling which cells to arrive when. It's a timing event, you know, it's just amazing how that happens. I love the autonomic nervous system. I just I can't imagine, Courtney, that event because you know the two systems working together, fight or flight. I going to get an injury, one takes over and says let's restore this, and that's a neural level. That doesn't even count the cellular level that's happening, and all these different systems are coordinating that little scrape.

Walline: Yeah. You got your integument, which contains your skin and all of your skin appendages, the immune system's there to make sure that any bacteria that got in are going to be eaten up but those macrophages and eliminated, those cells are secreting cytokines, which are chemicals. They're like little chemical trails that other cells with follow, and that's how they know that they need to go to the wound. And so fibroblasts will follow those chemicals and they'll secrete proteins that lay down connective tissue or we call it scar tissue.

Telemeco: It's building a scaffolding, right? Laying down scaffolding to repair the injury and then depending on whether the response is normal or abnormal, it becomes a scar or not a scar. Scar is a four-letter word. Scars are normal and so is inflammation. Those are normal processes that happen. But whenever anybody says the word scar, then they freak out. Scars should happen. Scars need to happen.

Walline: But you need to remodel them.

Telemeco: It's the remodeling piece that needs to happen. It's that next step that has to occur, so you know, when that fibroblast says okay that's enough and now I'm going to release the cells that eat that up to lay down the right stuff that can respond to the stress that the skin has to deal with. It's really neat.

Frederick: I love what you all are describing. I love the timing of it. How it just sort of, it’s like each new domino falls and it just unlocks, it has a self-check. Do I have enough? Yes you do. No I don't. Let's have a little bit more and then the next domino falls and all of these processes just unfold outside of our understanding.

Walline: There is kind of these like chemical checks and balances that are in place and once you hit that certain balance then the next step starts.

Frederick: Is all that happening on the neuronal level?

Carroll: I mean there is neural involvement, but I think the most fascinating thing is that a lot of these are programmed within the cells themselves. So, these are processes that are unfolding based purely at a cellular level and so they're regulating themselves or going through checkpoints or going through systems to make sure that you reach that sweet spot, that perfect balance for all of this.

Frederick: Well, let's change the problem. So I didn't just skin my knee. I turned my ankle running or God forbid, I was in a car accident and so there's something major structural. How does the body start that process, and Todd for you, when is it that experts come in to help retrain the body in terms of how to change the way it works?

Telemeco: You know, I think about the sprained ankle. I mean everybody knows about sprained ankles. The same actually processes apply. It was about that a cut and a sprained ankle really wants extra you can see it was internal and so those same processes are going on just to maybe a larger degree, depending on the extent of the injury.

Walline: even with bone breaks, too. The healing process for a fracture is very similar.

Telemeco: Yeah. It's a healing process. It's very similar. Yeah. They may last a couple different days. I mean, when I remember the charts, whether its bone healing, or tendon healing, or muscle healing, there's a different time frame, but the processes in general are the same. The same cytokines are released, the same chemicals are released, and the same process happens, the same cells are involved. The issue is with, when we talk about larger injuries is, as you said when do you bring in a health professional? It's when you become out of those windows. Let's say a typical information phase is the first phase is supposed to last anywhere from three to seven days depending on the injury and the tissue involved. Well, if at seven days we're still in inflammatory response, there's something else going on, and that's when a professional could come in and say, you know, we need to either back off or add this to it to help it get through the process because inflammation is good to a point, but chronic inflammation is not and so because then we get scar tissues laying down too long or the cytokines are there too long to simulate those fibroblasts and they dump out the wrong collagen. Last time I checked there were about 16 collagens.

Carroll: There are lot of them.

Walline: I have forgotten how many there are.

Telemeco: And so you think about that collagen, a single fiber in many different formats and each one has different properties to it.

Walline: a specialized function.

Telemeco: so if it's not the right one it becomes stiff. If you lay down the right one, it does the right thing, and so it's not just that one, its elastin, its fibrin, it's all those things together. And so those health care practitioners are coming in to make sure that we are going to follow a prescribed plan and that we stay on track for that.

Frederick: Something has got off kilter and they're making sure that they can figure out what did and take some measures to get back on schedule so that the right elements of the body are firing on its own.

Telemeco: And I think also with age, depending on the age of the person, you know, young kids recover faster, right? They do a better job, their bodies are more resilient. The older you are you may need a little assistance in there or a little extra protection to let the healing process happen because your process is slower.

Walline: Yeah, you heal slower. The immune system doesn't work as well when you are older. Another thing, my parents lament to me.

Carroll: There is also the problem of people not always listening to their bodies. You know, you might know okay, this is hurting. I should probably be in the rest phase still, you know, resting and icing and all that and you might say, well I'm just going to, I'm going to tough it out, keep doing my normal activity. Keep running on it. It'll get better. It'll get better. It did when I was, you know, five years ago this happened, it got better in a week. So we're out a week. I'm just going to, I'm just going to keep going.

Walline: So this brings up an interesting point. I had a student real recently that had a concussion and was told to rest. Don't go to class, don't study, something students are just waiting for somebody to tell them, you know, and I told the student, yeah, that's really important. You have to let your brain heal and you're kind of the neuroscience expert, you know, walk us through why it's so important to not push yourself when you have a concussion and let the brain heal.

Carroll: I mean, concussions are a big deal. I think we're only just starting to realize how big of a deal concussions are, especially when we talk about athletes who might be getting repeated concussions. You know, we really don't want to enter that TBI (traumatic brain injury) threshold, because while your brain is resilient to a certain extent and there is this, plasticity is the term we use where different parts of the brain can adopt or pick up these new functions to a certain extent, you can't do it all and so you really need to give yourself time to have the tissue help and heal. Neurons in particular are very high energy demand, so they're going to take a lot of energy, a lot of resources, in their normal firing, but even more so when they're in an injured state. So giving yourself a low brain burden, is really going help.

Telemeco: In today's world that is difficult, right?

Carroll: Oh, yeah.

Telemeco: I mean back when I was a kid we didn't have all these phones around. We didn't have all this technology. Now kids are exposed to all of that stimulus, all of the time, 24-7, and just to get their brain to stop is one of the most difficult tasks we have.

Carroll: putting away that phone and that light.

Telemeco: We should do that anyway, right?

Walline: Yeah, blue lights. That's another podcast we should do, talking about sleep.

Chancellor 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: You are listening to 30 Brave Minutes, a broadcast service of the College of Arts and Sciences at UNC Pembroke. I'm Jeff Frederick and my guests today are Crystal and Courtney and Todd and we're talking about the mysteries of the human body. What would you love to see some new research on next? What is the next mystery that motivates you and you would like to see unlocked.

Carroll: I know I've been talking about brains this whole time, but I think the brain is really one of the last frontiers of the body.

Walline: The immune system.

Carroll: Well, okay, let's maybe we'll say the brain and the immune system are some of the last frontiers of the body, you know, just because, in part, we've just now reached a place with technology that we can actually study what's happening in the brain, with some of the imaging technology that we have. Whereas, even 5 to10 years ago, it wasn't good enough to really see what was happening in real-time different situations. And so, there's still a lot we don't know. And the immune system, too.

Walline: Yeah, so there's part of your immune system that knows how to tell the difference between what's your body? What's normal to you and your body and then what's foreign. And in Immunology we call this self-versus non-self-discrimination, but your immune systems trained from the time that you're developing in utero to learn to be able to figure out, does this cell belong to me? Is it safe for it to be here or is this cell foreign? Is the cell foreign? Do I need to kill it and get rid of it? And that's how we fight infections, but we don't understand how the body loses control over that. And when it loses control over that they can develop diseases called autoimmune diseases, where your body mistakenly thinks that part of yourself is foreign and dangerous, and starts attacking it. And so depending on which tissue that is, will determine what type of auto-immune disorder you have. And so most people are familiar with multiple sclerosis and that's when the immune system attacks the central nervous system, the brain, and the spinal cord.

Frederick: So in Immunology, there's these ongoing things about selection and identification of cells and then signaling for what to do with it. And then on top of that, maybe even the body's ability to execute the signal for what to do with this cell?

Walline: Yeah, and a lot of it is regulation, too. Like, you know, if there's a cell that is going rogue and it's trying to attack, you know, let's say your cell in your brain, there should be other cells that come in and regulate that process and say no no no, that's a brain cell. Leave it alone. And we really don't understand those processes of what step is breaking down and why that regulation, and those checkpoints aren't happening.

Frederick: Todd, what fascinates you?

Telemeco: I'm a little different. I mean, the cellular stuff is very interesting. I did a cellular basis PhD but as I move on I think there's really, when I look at the literature, there really seems to be a gap between basic science concepts and then treatment options and really understanding what happens. It's a gap, to bring those two together, what I would call translational research and you know, we often provide treatments, especially in my world in rehab sciences, we're often prescribing techniques, which on one end from the outcome point of view the patient is getting better, but we don't know why and I would love to see that bridge change and I think is going to come with technology, because what's difficult is how to say that in Vivo in the body while the healing is happening and really understand that process. You know, we can't pull a petri dish out and do some draws, but really to see that process in Vivo would be fascinating to bridge that gap. That's what I look for, that translational research. To me that's critical and you are starting to see it with technology. Imaging is helping. New imaging techniques are really helping that, but I think if we could find new markers that we can see in different ways are going to help that process as well.

Frederick: So if I hear you right, right now we're able to see what the body does before and after and then we can sort of extrapolate what happened, but we can't really see it as it is happening in real time.

Telemeco: Exactly. I'll give you a quick example. We, in my world of physical therapy, we do a lot of things called joint mobilizations. And we think that depending on how much force I apply, I'm stimulating fibroblasts at one point to lay down the correct way. Now, I don't really know that to be true. It sounds good on a concept. I know my patient’s range-of-motion gets better. I know they function better, but I really don't know at the cellular level whether I've actually stimulated fibroblasts to lay that fiber down in the right direction.

Frederick: You need a report.

Telemeco: Yeah.

Frederick: Please send a report to my cell phone to let me know if my fibroblasts are laying down.

Telemeco: Exactly. And, it was funny, because my research was on that. I took little cells and I put them on a stretcher, it looked like a medieval stretcher in a petri dish.

Walline: He racked his cells.

Telemeco: I did. I racked my cells and I would turn those little rubber stretchers and see if the direction of tension dictated the way the fibers laid down. I don't know if that translated into the body though. I do know on a piece of rubber I could get it to lay down a certain way and I could get certain chemicals to be released, but I don't know if that translates into an actual hands-on application.

Walline: Yeah, we have a long way to go for that bench to bedside research, you know, getting stuff from the conceptual phase or the molecular or the cellular to how does this fix a disease or how does this make the body work better?

Carroll: A lot of those issues do come down to the models that we use. If you think about the types of diseases that we seem to have a pretty good handle on, those are the diseases that the system in the humans is similar enough to the system in mice and rats that the model is appropriate. You know, you think of cardiac function, right? We can model cardiac dysfunction really well in certain animal models and we get an understanding of what's happening. We can screen drugs, we can make advances, but you think about the systems where we don't know what's happening. The immune system, the nervous system. That's when the model falls apart.

Walline: But we study that by, you know, taking a brain out and studying the brain, or taking a spleen out, which is an immune system organ and studying it, but it's really hard to get patients to donate their brain and their spleen to you so that you can study it. I think you can imagine why that is.

Frederick: Yeah, even I can figure that out. Alright, so a last question. This has been a great discussion. So with all of what you all, individually and collectively, know about the body give our listeners either one thing we should do more of, that would help our body to do good things, or your glass of water can be half empty - one thing we should stop doing or do more regularly in moderation in order to prevent the body from breaking down.

Telemeco: Sleep.

Walline: That was mine.

Telemeco: That's why I got it in their early. It's on both sides. I think we need to sleep more and get the seven to nine hours your body needs active rest at all cellular levels, whatever system you are talking about. And we need to do more of it.

Walline: I would add to that, since you stole that from me, I'm going to piggy-back on that. Not only do we need more sleep, we need more quality sleep. Quantity is not enough and we kind of mentioned earlier the blue light that your electronic devices give off. That actually can alter some of your hormones in your body and it prevents you from getting into those deep stages of sleep, where that repair and refreshing aspects of rest really come into play. So, improving quality and quantity of sleep, yeah, I totally second that.

Carroll: I think honestly most people know what you are supposed to be doing. It's just not always the fun stuff, you know, like the data on red wine and chocolate is mixed at best, I would say.

Telemeco: I know.

Carroll: But we're really happy to follow that, right? And coffee. I bookmark any coffee study I can find because I'm drinking about 4 cups a day, but no, the stuff that you know is good for you, exercise, eat right, eat a lot of plants, you know, eat a high fiber diet, get out there. Get as much exercise, you know, as your schedule allows you to. That's the stuff that's going to help you, and also maintain your social relationships. Especially as we age in today's society, a lot of people are more and more isolated and there's a lot of research that shows that maintaining social connections and staying part of a community group is one of the best things you could do for yourself as you get older.

Telemeco: I think that adds, too. The community piece you learn from other people because I remember before I was really 'meat and potatoes,' right? That's what I grew up on.

Walline: A proper Midwestern diet.

Telemeco: Right, exactly. But as I've matured, and around different folks, learning about the benefit of plant protein and how really that's probably a better model long term for digestive health and a lot of other things, but being open to those ideas and being around the right people lets you be open to try new things that you probably growing up were not so willing to try.

Frederick: Knowledge is knowing that Brussels sprouts are good for me. Wisdom is actually eating them. I'm knowledgeable, but I'm not very wise. This has been great. I learned a bunch today and I hope all of you who are listening did as well. Thank you to Courtney, and to Todd, and to Crystal for joining us. And for all of you join us next time again on 30 Brave minutes.

Richard Gay: Today's podcast is edited by Richard Gay and transcribed by Janet Gentes. Theme music created by Reilly Morton.

 Thanks for listening to 30 Brave Minutes and go Braves!

Good job, everybody.