Transcript

Speaker 1: You're tuned in to 90.7 FM, k a l x Berkeley. My name is Tesla Munson and this is the graduates, the interview talk show where we speak with graduate students about their work here on UC Berkeley campus. Today I'm joined by integrative biologist, White Spring Thorpe and a, he's in the field of biomechanics. So thanks for coming today, Dwight. Thanks. It's nice to be here. Yeah. And to start off by telling us what year you are.

Speaker 2: So I'm in my third year, uh, which means that I've passed my quals and I'm now trying to, um, get to the bulk of my thesis and [00:00:30] uh, finish up and

Speaker 1: that sounds good. What is bio mechanics? I mean, I know what mechanics are.

Speaker 2: Biomechanics is most broadly the science of how organisms move. Uh, but more than that it's how will an animal's anatomy, physiology, neurobiology, and the properties of the environment all come together to give an animal to capabilities that we observe.

Speaker 1: Okay. So biomechanics is basically understanding how an animal or a plant or an organism moves in general and how they use their body to accomplish [00:01:00] things.

Speaker 2: Yeah, yeah. I'd say that that's correct. Your controls strategy or how will you actually activate your muscles is going to be dependent on the mechanical properties, right? And if you have real long legs, then you might be a good long distance runner, but you might not be able to change direction as quickly. So a really good example would be say in cockroaches, uh, you know, these, these are really small little animals that they run really quickly. If they were scaled up to the size of a human being or something and they'd be running about as fast [00:01:30] as a car would drive on the highway. But these and these animals are running with their legs and they're missing steps. Sometimes, you know, they'll, they'll step on a piece that moves or, um, you know, get into some gravel or sand, whether the traction changes suddenly and they can react rather than having to think about it like you or I would, you know, if we miss a step, then we think about it.

Speaker 2: We correct, you know, we stumble. Uh, instead, these animals are able to use sort of the mechanics of their legs to compensate [00:02:00] without having to think about it. Essentially their legs are tuned in just such a way that they're able to ignore a whole bunch of different kinds of perturbation all without having to think about it because cockroaches can't think no, they can think, ah, if you have a sufficiently large perturbation, then they will correct. They'll uh, they'll change the way that they're running. They'll, you know, they'll stumble just like you or I might. But we find that especially for animals with really high strides frequencies like, uh, like these cockroaches, [00:02:30] you know, they're running, you know, tens of steps per second. They're able to ignore a lot of it, which makes their lives easier. Then you can think that they're able to perform a much broader range of tasks or have a broader range of capabilities without having to have a bigger brain.

Speaker 1: So this is just another reason that cockroaches are going to be like post-apocalyptic survivors hanging out with the Twinkies.

Speaker 2: They've been around for a long, long time and I that they'll be around for [00:03:00] a long time to come. Very cool. Speaking of being around for a while, where, where do you come from? You have a background in physics? I know. Yeah. So a, I did a bachelor's of science in physics at the University of North Carolina at Chapel Hill. And that's where you're from? North Carolina? Yup. From North Carolina there. I studied a bunch of different things. It was a fairly standard physics major, did some astronomy, uh, you know, studied a bunch of different applied topics, a fair amount of lab work. They have a really good program there for getting undergrads [00:03:30] interested in research and involved in research. And, um, then I stayed there to do a masters in biomedical engineering where I did a few different things including, uh, some tissue in your, uh, sorry, tissue engineering also looked into manufacturing biofuels, uh, using algae.

Speaker 2: And then, um, I, my master's thesis was actually on designing scientific instrumentation where I was working in a biomechanics lab. Uh, [00:04:00] I was working ty Hendricks lab there and he studies flight biomechanics mostly in, um, mods. So it's a large, you know, fairly large moth about the size of a hummingbird, but they're really good at hovering and they can fly around in these low light conditions. And they're very, very good at flying in unpredictable environments that you would expect when you're a fairly small animal flying next to all these flowers and bushes and things. And so one of the things we wanted to to study was how they're actually activating [00:04:30] their flight muscles because you know, they sort of have a rhythmic pattern that goes over and over and it goes with each wing beat. And, uh, we wanted to kind of understand how that pattern was subtly changing in response to different perturbations.

Speaker 2: And one of the things we needed to do was to get this information from animals that are actually flying freely. Cause you can, you can tether them, you can, you can put electrodes in their muscles and record from them just like you would any other animal. Uh, but if you put them on a, on the end [00:05:00] of a stick or something so that you can use more conventional, larger scale, uh, recording apparatuses, the animals aren't really behaving freely. So you get behaviors that you wouldn't really expect to see during normal free flying behavior. That's cause they're on the end of a stick. Exactly. It's exactly what you would expect. I mean, you can do some great work with these animals on the, uh, on the ends of these sticks. What does that mean? Can you just, I have just a really weird image in my head.

Speaker 2: What would you say? Is it literally just on the end of the stick? Yes, [00:05:30] quite literally. There is a, usually some kind of small metal or wooden rod and it's affixed to the top of the animal's thorax. So that's the middle part right behind the head. Uh, so that the animal is sort of fixed in space. They're able to move their wings quite freely and you know, their legs aren't touching anything, so they think they're flying in the mouth on a stick part. It's fun. It doesn't, it doesn't hurt them off. Like it's, it's fine. The mods have no problem with it. Yeah. Like it, it doesn't hurt them all. And this isn't, you know, there's no permanent [00:06:00] damage of any kind, but you're missing a lot of that feedback loop that you would expect cause they're not, they're not feeling the wind when they try to turn, they're not always feeling that it turns.

Speaker 2: And um, you know, if you don't have sort of a virtual reality environment for these, for these models, then you'll find that they don't see a turn either. Now there, there has been some really good work at University of Washington for instance, where they've built these really cool virtual reality environments for malls where the Malta's on the stick, but as it turns, [00:06:30] they're able to sense that torque. And then the screen that the mouth is in front of actually responds, giving the moth a visual response that re mimics what it would expect to see when turning. I was like a little video game from all [inaudible].

Speaker 1: So they've got virtual reality for moths, but I can't buy it.

Speaker 2: It's a, you were, I would would probably not derive as much enjoyment from it as the mall this because we have a better visual system. But you know you're looking, usually it might [00:07:00] look like a series of black lines on a white background to simulate a forest of vertical tree trunks and then white open space. It's fairly simple but it's sufficient for the mall. This to navigate by.

Speaker 1: And this, this is an issue that comes up in a lot of biology studies, the idea of captive versus wild experiments, right?

Speaker 2: Yeah. So like I said, one of the things that we wanted to do was to start understanding like what are real free flight behaviors looking like? [00:07:30] What is the natural variation of these patterns of motor act, of muscle activation. And so one of the things that we built, which was actually my master's thesis, was a radio telemetry system which can be carried on these, these moths. So it's, you know, around 750 milligrams or about a third to half of the Mott's body weight. They can actually carry a whole lot. Like these are three grand malls, but they can easily consume up to a, a gram or two of nectar and then fly away. And when [00:08:00] we put this on the animal, we are able to put the electrodes in there and transmit out the muscle activation signals to a, to a base station and record them simultaneously and start to understand how natural freely behaving mods are different than some of these tethered preparations. We were able to bring that full feedback loop together. They're able to get the sensation of turning the visual information from turning. Everything's there.

Speaker 1: Awesome. And you know, besides [00:08:30] these little tiny radio telemetry devices, I, I've been in your lab, I know you guys got some crazy things going on there. There's wires and cameras and tell me some, what are some of the equipment that you guys use in your lab? The biomechanics lab now?

Speaker 2: Sure. Uh, so we've got a whole bunch of different equipment. We have high speed cameras. So these are cameras that are essentially video cameras except they can record at many thousands of frames per second, which is really critical when you're trying to capture some of these really fast, [00:09:00] fast behaviors. You know, like I said, cockroaches are running at tens of Hertz, so you need many. You, you want to be able to see that in a lot of detail. We have forced platforms and other ways to actually measure the forces of the animals are exerting on the environment. Treadmills, uh, obstacle courses. The backpacks that I mentioned, we'll use sensor packages that are like that. In our, in our research we have things to measure oxygen consumption so that we can start to, to estimate the metabolic cost of different [00:09:30] kinds of locomotor tasks. And, uh, personally I'm using x-rays to examine, um, the ghost crabs when they're burrowing.

Speaker 2: And then all of this, you can use different computer techniques to start understanding these behaviors. For instance, if you have a couple of different cameras recording an animal from a few different angles, you can reconstruct the 3d position so that animal's body and appendages. And that way you can get really well quantified data [00:10:00] on how will the animal is moving. So beyond just a description of this is the behavior, you can start talking about the actual kinematics of each appendage or of the body. And we're able to do that with the X-ray as well. So some are in planning to take some new data using a multi-axis x-ray systems so that you can get three d reconstructions of ghost crabs as they burrow.

Speaker 1: And this really is a little bit of a tangent, but this really actually reminds me of that famous series of photographs from like the turn of the 19th century with the whole, I think it was a horse, right. And [00:10:30] it was like the first time they'd ever been able to see that the horses legs are all off the ground at the same time or or something. Cause they took still frames of the horse running with the new photography technology.

Speaker 2: Yeah, exactly that. That's one very famous example where, uh, if you look at paintings and things of horses before they were able to take those, those first photos, you'll see that people have painted or drawn the horses running in a way that the horses never do. Um, but as soon as you're able to [00:11:00] look at things with, uh, with these high speed cameras or in their case, you know, with basic photographic equipment, uh, it's things that your eye would never be able to perceive. Uh, and then that gives you a whole lot of new information that you wouldn't be able to get otherwise.

Speaker 1: If you're just tuning in, you're listening to KALX Berkeley 90.7 FM. My name is Tesla Monson and this is the graduates, the talk show where I interview graduate students here at UC Berkeley about their work on campus. Today I had the pleasure of being [00:11:30] joined by Bio mechanistic Dwight Spring Thorpe from the Department of integrative biology here on campus and the valley life sciences building. And you mentioned ghost crabs. I know that some of the work you're doing right now, can you tell us a little bit more about that?

Speaker 2: Sure. So I'm broadly interested in the idea of animal multi-functionality, which is when an animal uses the same set of appendages to perform very different tasks. So a lot of animals, you could even say all every animal is [00:12:00] multifunctional to some degree. So for instance, you know, when I'm walking I can use my legs to walk up the ground and climb up stairs. So those would be sort of different tasks. If you think about a a fly, uh, you know, they've got legs for walking and wings for flying and that's sort of multi-functional. But where it's really most interesting is when an animal is using the exact same set of appendages for very different tasks. And the ghost crab is excellent for that. So you've got [00:12:30] these ghost crabs, which are sort of smallish crabs living on the beach, about 10 centimeters to 20 centimeters legs span.

Speaker 2: And they're first, they're runners. They are the fastest land in vertebrate. They're able to run up to four meters a second, which is really, really fast. If you've ever seen them on the beach, they're all up and down the the beach of the southeast coast. You'll see them at night and then they'll be gone in the blink of an eye. So they're, they're really running specialists, but at the same time they're able to [00:13:00] capture and manipulate, prays. So they have these really cool prey capture responses where they lunge and grab things. They, they're very dextrous even though their claws are, are fairly simple, like they are able to perform tasks that you or I would perform with our hands. But instead of having, you know, 10 fingers with many degrees of freedom or many joints in each hand, they, they really only have the one joint that pinches.

Speaker 2: But they're able to, for instance, capture a prey item and then kind of flip it upside down. And then I've fed [00:13:30] them cockroaches before and I've watched them pull off the legs one by one and eat them like chicken wings. And more than that, they're also able to build these long complex burrows in the beach. And they, they use these for, for shelter and for hibernation. Um, you know, they stay in them during the day when it's hot. And these, these burrows might be, you know, a meter, a meter and a half long going, you know, up to a meter below the surface and they have a branching structure. They really quite complex and the animal is able to perform all these tasks [00:14:00] with the exact same set of appendages. So they've got these, these legs that, you know, if they're specialized for anything, they're specialized just for running. But yet we see that they're able to build burrows to jump, to climb, to capture, manipulate prey.

Speaker 2: They fight with each other. You know, you're seeing a really broad range of tasks all from a fairly simple set of appendages. Why, why is that? Why, [00:14:30] how can they do all that stuff? Well, that's what I want to understand. Uh, because if you, if you look at a robot with, you know, that we have right now, a lot of them are, can be really good at a single task. You know, you'll, you'll see robots that are really good runners. You know, really good at say, assembling a car or something, but getting a robot to do something new or to sort of be multifunctional is quite challenging. And the, the animals are able to outperform robots and in a lot of ways and by understanding [00:15:00] what properties of the ghost crab are really enabling this multi-functionality, how, how is it that this animal is able to do all these different tasks with, uh, that same set of appendages?

Speaker 2: It could be that it's, uh, the control system. So it's how the animal thinks about moving it. Uh, so x-ray data that I took a couple summers ago of a ghost grabs building burrows. So these were animals put into a sort of an artificial beach environment and they were allowed to build a borough. While I x-rayed them. It showed [00:15:30] that the animals are using their, uh, walking or running legs to actually remove and transport the material that when they build their burrows, so their running legs are going from being these sort of spring-like running appendages to being these appendages that are inserted into the material and then contracted. And then, you know, that removes material from the end of the bureau and then they're able to use them to make a basket to sort of carry the material [00:16:00] up and out of the burrow. Or they can pass the sand across their bodies inside these little burrows, which really aren't much bigger than their bodies.

Speaker 2: So really very confined environment and they can push that sand across their bodies and then push it with their legs. So it's the same, same appendages just used very differently. So we think that, uh, a major component of animal multi-functionality is the sort of control system is all right, the animals brain. But at the same time, there are animals [00:16:30] that live in the same environment as the ghost crabs. So the mole crab, which is neither a mole nor crab, that is a burrowing specialists. So it has a lot of the same appendages that you see on the ghost crab. But instead of being able to perform all these different tasks, it's really just good at burrowing. It's much faster at borrowing. It can go like about half a body length in a, in a second. And when it burrows in its natural environment and it goes scrubs a much slower burrowers, you know, they're going, you know, a centimeter or so a minute.

Speaker 2: But the mole crabs really can't [00:17:00] run. They can't run. They really are just burrowing specialists. But they have the sort of same appendages, same broad set of appendages. But understanding not only how those appendages are controlled in the ghost graph to see how the animal becomes multifunctional, but also what is it about the structure of those limbs? Because the mole crabs appendages are obviously designed for digging there. They're very short, very broad, so they can generate high forces. Um, so that [00:17:30] the pressure to become a really good burrower probably pushed the animal out of the ability to run right because it needs that really high burrowing performance to get away from the ghost crabs. Actually, they're ghost crabs like to eat them all crabs. So they were pushed out of that ability to run because they needed that performance advantage. Uh, whereas the ghost crabs have these very differently shaped limbs.

Speaker 2: So that might be a component of multi-functionality, might be how you control it. But also the shape of the appendages, [00:18:00] the number of joints you have, you know how you use those joints. So when you say how you control it, that's some of your experiments are not just about looking at how the limbs are moving, but it's about behavior and trying to understand the behavior of the animal. Yeah, so that was the, that was really the novel thing that we, we found in my, my first X-ray at work is that people hadn't really seen how the ghost crabs borough. There was, there was some information from watching them at the front. People knew that they were sort [00:18:30] of using their, their legs and their claws to collect and transport the material. But you know, if the animal digs a burrow, then you're going to lose sight of it.

Speaker 2: You can't really see through sand. So when we were able to use this x-ray system, we were able to, we were able to see how all the appendages were moving and where the body was. And we found some really neat things. Not only is the animal using its walking legs to collect and transport material, but it's using several different strategies kind of all at once. So [00:19:00] it has this sort of hook and pull motion where the insert their, the tips of their legs and the material and then contract them and draw material out. But they also have this sort of repeated scratching, uh, that we think they use to loosen material. The, the way their legs move, they can't really reach above themselves. That's why the safe way to grab a crab as to come from above, you know, they can't really reach up, they can't get to you.

Speaker 2: Uh, and that would, that would obviously impact their burrowing. Like if you couldn't reach up then your borough would sort of, you could go down [00:19:30] and maybe straight a but we don't see that and they'll go scribe Burroughs. Instead they have these sort of complex and branching structures. And, uh, as soon as we put the animals in the X-ray, we found that they have this sort of neat trick where they, they actually are using their claws to push themselves into like anchor themselves within the borough. So they pushed with their claws and then the back of their body, their anchor and then they're able to spin within their borough so that you can, they can spend all 360 degrees all the way around and they'll do this while simultaneously [00:20:00] using their legs to collect material from the end of the borough. And we think that that might also be one of these bigger ideas of multi-functionality.

Speaker 2: It's not just how your legs are shaped or you know, how your, you're actually activating, it's this sort of synthesis of different strategies at the same time that really enable a new behavior because the animal went from sort of having these walking legs that can kind of scratch it, the material. But if you add the rotation, the whirling dervish, sure. [00:20:30] If you add that in, suddenly the animal can reach a whole new space. Like the animal can reach now above itself. And it can get to all different parts of the burrow and that lets it go around obstacles that we find in the beach and you know, controlled the, probably controlled the direction to build these, these branches that they like to have in their burrows. And that may be another big component of the broader idea of multi-functionality.

Speaker 1: Okay. So we've talked a lot about ghost crabs. Are you working on anything else in the lab that you want [00:21:00] to talk about?

Speaker 2: Uh, I don't, but my lab mates are working on a number of different things. One really good example of how the shape of an animal contributes to its capabilities is this thing that postdoc Chinley in our lab has found. He's was running cockroaches through this field of sort of artificial grass. It was paper cut into a sort of a grass shape and he noticed that the cockroaches would, would often make it through this pretty difficult obstacle and they would do so as they ran through, they would turn on their side and, and sort of like sidle through [00:21:30] the grass. And he really looked at it and he's like, there's something about the shape that is doing this. Cause the, these cockroaches have this large sort of shield or rounded shield shape above their head. And as they were running through the grass, it's like turns them on its side and they can sort of go through.

Speaker 2: And that's, that's really neat because it's a passive structure that gives them a new set of capabilities. They don't have to think about how to turn themselves and get through the grass instead [00:22:00] as they just run full speed through the grass. The way they're shaped naturally funnels them into this configuration that lets them move through this obstacle. And so one thing that we were able to, to do is actually implement that on a robot. So we have these little robotic models that run a lot like a cockroach and they were running through grass and then we get stuck all the time. But as soon as we put a shell, you know, sort of an almond shape shell over that robot that sort of resembled the [00:22:30] shape of the cockroaches sort of shield that's over its head. Uh, the robot naturally turned on its side too and went through the same obstacle.

Speaker 1: Very cool. So, and there's a word for this actually, like biomimetics right. That's, that's a real word. We would say bio inspiration. Okay. Well, can you, for either of those terms, can you define it for the audience?

Speaker 2: Sure. So I would say that biomimetics is the idea of copying the form of nature. And often it's, it's a good idea because if you [00:23:00] make something that's shaped like an animal, then it may have the capabilities that that animal has. But we try to go for a deeper understanding of what the animals are doing. So we try to really understand the fundamental principles that are enabling an animal's capabilities. So it's not just, Oh, let's make this robot look like the animal, but it's, let's study the animal until we have a good working theory of why this animal shape is giving it these capabilities. [00:23:30] And then take the core principle of that and apply that to the robot. And that's what we call bio inspiration, understanding the core principles, and then applying them. Uh, and that's, we think that's a better way to go because animals are, they're not optimized for specific tasks or doing a lot of things.

Speaker 2: So a cockroach is, you know, yeah it's running through grass. It's trying to get away from predators but it's also trying to find mates is trying to collect food. It's trying to keep itself warm and [00:24:00] dry. And you know, it could be that the shield that we saw there serve one of those purposes. It could be that that shield was just really attractive to a two lady cockroaches. Yeah. Yeah. The idea of bio inspiration is we think the better way to go because you understand more of the fundamental principles and so you're able to take out some of the other things that the cockroaches having to do. Cause we don't want a robot that is very attractive to lady cockroaches. That's not helpful for us. [00:24:30] So we want to understand just what's contributing to the feature that we're interested in and then apply that rather than just making the robot look like a cockroach.

Speaker 2: And you said that's not helpful for, for you, what exactly are you trying to do? Why build a robot? What's the point of all this? Sure. So at least in our lab, we're really interested in translating what we learn about animals into new technologies or something. I mean, we're, we're doing basic research. It's all fundamental scientific research on [00:25:00] how animals move. But if you look at animals compared to see robots, even robots that are directly inspired by that animal, you'll find that the animals are really outperforming the robots in almost every way. You know, they're more robust. They can handle broader sets of obstacles, you know, they're faster. And by understanding the principles that allow animals to do this, we think that we can really improve robotics technologies. So we can, [00:25:30] for instance, inspire robots that are able to run through grass or handle rough terrain better.

Speaker 2: Or, you know, if you want do a apply my work, then you would, you might be able to build a robot that is much more multifunctional. This could see application, you know, well beyond robots as well. You could see this being used to design better prosthetics, biomechanics at the cellular level could even be say the transport of molecules throughout the cells or throughout the body. And so by understanding biomechanics [00:26:00] at many different levels, you might even coming up with improvements to drug delivery. So are you going to build things forever? Is that really where your, your passion lies? I do really enjoy building things. So I've been building these sensor packages for the animals and built several different generations of 'em all using this really nice open source architecture. So I'm hoping that not only will it be useful in our lab for learning new things about the animals we study, but you know, it might also be useful for any [00:26:30] other that labs that are looking at um, animal motion or you know, need a sort of wireless sensor package or data acquisition system. You guys hear that Dwight Sprinkler up here with his

Speaker 1: miniature data sensing packages? Yeah, yeah. No. So you're building things. You could be doing that forever with, let's just talk for a minute about what other students can do to become a builder like yourself, or to [00:27:00] understand the fundamentals of, you know, mechanics and animals or any of the interesting things that you've worked on.

Speaker 2: Sure. So I'm the first one I really got into building things very young age. I was playing a lot with, you know, even Legos, things like that. Uh,

Speaker 1: we know you're still playing with Legos. I heard you have legos in your lab

Speaker 2: please. Their, their chins and, and my legos are in my mother's basement. Oh, okay. Sure. [00:27:30] Um, but a lot of it is just learning by doing. I mean, I picked up some of the principles of building things and I was doing my undergraduate degree in physics and when I was doing my masters in biomedical engineering, but a huge component of the ability to, to build something new is really experience and just trying things. It's a fundamentally creative process, which I really enjoy. Uh, you know, when you're, when you're [00:28:00] building a, say a robotic model that you're gonna use to start understanding the principles of animal locomotion, it's fundamentally creative. You have to kind of look at what you want to build and then there's sort of a broad class of things that you shouldn't do, right? You probably shouldn't connect the battery backwards for instance.

Speaker 2: And uh, and there's a bunch of things that you probably should do, right? So there's good practices in different parts of engineering, but outside of those bounds, there's a bunch of things, like a bunch [00:28:30] of different ways to solve the same problem. And I really enjoy that iterative process of a little more, let's try it this way and then, you know, see how that works and then try a few different things and go back and forth. And as you do that, you learn what works and what doesn't work and then that's experience that you keep with you and that you can use to apply to problems in the future. And eventually you have this huge set of experiences so that you can, when you're approaching new a new problem, you can most almost right [00:29:00] away rule out different ideas. And I see this, you know, a lot of Undergrad classes don't teach this, but there are a number of, of classes that do design programs are really good.

Speaker 2: Uh, working in a lab was really good, especially in my undergrad and master's programs. Uh, you know, we needed new devices to, to test things, you know, to unders to do different scientific problems with like the fundamental goal was not to build something new but rather to build something [00:29:30] new that enabled a new scientific discovery. But in having kind of a different project every week like, okay, let's build, you know, a camera system, now let's build, you know, a radio control system, let's build a bunch of different things. You can get a really broad set of experiences. If someone was interested in really learning how to build new things, I would say that, you know, working in a, in a laboratory is a great way to do it. You know, get involved as an Undergrad or you know, as a master's student or even [00:30:00] just go to Grad school and uh, you can really have a lot of opportunities to build different things.

Speaker 2: Even though it's not a classical engineering track. You can still get a lot of the experience and your goals will always be to make something that works. So in a lot of ways you'll get away from sort of the heavy theory and move straight into how does this work in the real world. Um, highly encourage undergrads that are interested in engineering or building things to work in labs. I know that even though we're a biology [00:30:30] lab, all the graduate students in my lab now have backgrounds in physics or engineering and many of the undergrads that we take come from either engineering programs or you know, bioengineering programs. We have biologists too. We have a, we like to have a, a broad group of people are a broad set of experiences in our lab cause it's really integrative program.

Speaker 3: Um, but

Speaker 2: yeah, there's no reason why if you're an electrical engineer and you can't try working in a, in a biology lab.

Speaker 1: So [00:31:00] I think there's one question that everyone out there has for you. Are there any robot wars on campus so we can go to

Speaker 3: oh, neath Hank.

Speaker 1: Oh, you've got a serious answer for that.

Speaker 2: Yeah. Well that's the thing. Like there should be, yeah, there, there should be. Yeah. Her robots don't often fight each other and usually they're, they were hand-built. So they are quite precious to us. Care for them. Better than a, I'm not going to say that. Yeah. But the robot wars, [00:31:30] well, W it would be interesting. Uh, we, robot races sometimes, so our rope, sometimes if we're testing different designs, the robots will, we'll race against each other and we'll, we can start understanding, you know, what aspects of this or of this robot shape are contributing to the differences in performance. [inaudible]

Speaker 1: okay, well, if we ever get this robot war thing going, you know, get memorial stadium opened up, I can do the live broadcast. We got it. We had it hooked up.

Speaker 2: [00:32:00] Um, well

Speaker 1: we're just about out of time here. So do you have any last words for the audience?

Speaker 2: Yeah, yeah. Uh, I would, I would say that basic research is really important because you never know where the next new technological breakthrough is going to come from. Biological research especially there's, there's so many animals out there and there's so many animals with different capabilities that, that we don't understand. We don't understand how they work or how the animal is [00:32:30] able to maintain the performance that it does. And I really think that it's important to support basic research because that research can translate in the new technologies that you never expected from our lab. A few years ago, people were looking at, at Gecko feet, they were looking at just how Geckos are able to climb up the wall. And so you might say that that would translate into a robot that could climb up the wall and it did. But more interestingly, it also translated [00:33:00] into a new adhesive technology that's being, that can be used for bandages.

Speaker 2: You know, they're thinking about this as a, as a way to make these bandages that don't cause any pain when they're removed. So this can be great for say, burn patients or you know, anyone who just doesn't like having a bandaid ripped off. And all of this came from basic research where there was never a set goal to say, we're going to build this bandage. Hold on. Hold a child to the wall. Yes. Yeah, yeah. My advisor has a, [00:33:30] a video of his, of his, a former Grad student taking this grad student's firstborn child and attaching it to a harness connected to it, you know, piece of this adhesive and able to hold the kid up and that's, that's trust. Yeah. Um, that's the, yeah. That's belief in your work, Huh? Yeah. And, but all that comes from basic research. Uh, you know, you've got this, the idea that we're going to do fundamental research because it is sort of its own reward, but [00:34:00] really it should be supported because it can translate in so many different ways in ways you didn't expect. And I really encourage people, even if you're not on a scientific track, you even if you want to go into industry or a non scientific career, um, to get involved in research that they can kind of understand that sciences is a fundamentally creative process and there's a lot of room for people of all different experiences [00:34:30] in science and that that work can translate to really unexpected things that benefit everybody. Even those people that aren't gonna go into science

Speaker 1: wise words from Dwight Spring Thorpe here on the graduates. That's right. You've been listening to KLX Berkeley 90.7 FM, the graduates, the interview talk show where we speak with graduate students about their work here on UC Berkeley campus. My name is Tesla Munson and again, I've been here today with integrative [00:35:00] biologist, White Spring Thorpe. And thank you again, Dwight for being here today. Thank you so much. Yeah, and we'll be back two weeks from today with another episode of the graduates. That's right. Joined us at 9:00 AM on Tuesday, July 29th to hear from wildlife ecologist and Morgan Gray. Until then, stay tuned. You're listening to k a l ex.