Grow Everything Interview Transcript: Cas Smith

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CAS: Their child was like, “Oh, wouldn't it be cool if when it's raining, our umbrellas were able to show us the different microbes in the raindrops as they hit the umbrella sheet? And it would like, light up different colors or something.” And I was like, that's cool. I never would've dreamed about that.

Intro

KARL: **Hey, Erum. How are you?**

ERUM: **Good. How’re you doing, Karl?**

KARL: **Pretty good day today. Every day is a good day.**

ERUM: **Yeah. Are you feeling better? I know it's that time of the year. People are feeling a little sick?**

KARL: **Yeah, I'm still a little congested. I may sound that way, but I'm definitely on the mend. I'm super excited about this episode we're having with Cas Smith of Gingko Bioworks.**

ERUM: **Ginkgo is the biggest player in synthetic biology, so it's going to be great to hear his perspective. I think he's going to be one of hopefully several people from Ginkgo that we bring to the pod. And I know you know a lot about Ginkgo, you wanna give our audience an overview from your perspective since you've known them from the beginning.**

KARL: **For those of you who don't know, Ginkgo is an organism engineering company and what that actually means is they will program a cell for a client to produce a product or to have some kind of activity that cell might not have had in the past. And it's a publicly traded company, went public in October of 2021, and they traded the symbol of DNA, which, the DNA symbol had been Genentech back in the day. Genentech was bought by Roche, so then the symbol was available. And passing the mantle of the DNA symbol to, Ginkgo Bioworks is a great thing.**

They're a big company. They've grown a lot over the past few years. The company was started by four grad students and one of their mentors out of MIT. The whole team is really interesting and dynamic, and the company has a number of spinoffs. But I think we should just have Cas talk about, communications at Ginkgo. He's on their studio team. And what exactly does that mean, Cas will tell us.

ERUM: Yeah, absolutely. what's interesting too is Ginkgo is really positioning itself to be more like a platform, like AWS in the software world where a lot of companies are built on Amazon Web services. So it seems like Ginkgo is in that realm. Like they're really trying to create, like a base technology for a lot of companies to build upon, the intellectual property that they create. Are there other, competitors to Ginkgo, just outta curiosity?

KARL: There's other companies that you can go out and hire to program a cell for you. the biggest competitor was a company called Zymergen, but they were focused on something else and, they had some heartbreaks and Ginkgo ended up acquiring them.

Some of the early. let's just say version 1.0 synthetic biology companies like Amyris would be somewhat similar to Ginkgo, though, I believe Amyris only engineers one kind of cell. That might be yeast, that might be e. Coli. I don't remember exactly, but they focus on only one microorganism, whereas Ginkgo focuses on several.

And then there's other companies, like Conagen is a smaller company that does a lot of the same things that Ginkgo does. but Ginkgo's unique in its scope and its breadth and the kinds of things that they do.

ERUM: Yeah, I think they borrow a lot from the technology world. so they have a cell development kit to make it a little bit more, I guess modular and systematic for people to get started, just like Amazon Web Services does.

So it's really cool to see how they do that. In this world of biotechnology, sometimes we can borrow from the world of software engineering. Sometimes we can't. So in this case we can, because I think it's, as a platform technology, there are a lot of similarities, but yes, Cas can definitely tell us a lot more. He is a rare breed of creative and scientist, he has both brains functioning and he's one of our friends. Definitely a little bit more, conversational with this interview.

Transition

KARL: When we say grow everything, what does that mean to you?

CAS: Grow Everything means, anything that's physical, we can grow it. Everything in your house. Your house, everything on you. Your phone one day.

KARL: I like the idea of software battling itself out. If software was alive, Then wouldn't software do like, what bacteria does where you've got Zoom, but the X app has a better, phone app. So the X app eats the Zoom app and only takes the code that works for it, and then discards the rest, just like biology does.

ERUM: Like survival of the fittest.

KARL: Totally. So, Cas, you're a long-time friend of this podcast. This is, we hope the first of many appearances that you make. Why don't you tell us about yourself, your role, what are you doing these days?

CAS: Sure. I work at Gingko Bioworks. I'm in the Ginkgo studio. I'm a director there and our mission is to help people understand what synthetic biology can do for them.

So helping various customers, business people, random people on the street understand, hey, biology is a thing, that can actually do a bunch of awesome stuff. It's not just a high school class you took a long time ago and there are companies today doing really cool things with it. So our work spans from super straightforward, haha business, helping market the services that Ginkgo provides, all the way out to, making cultural artifacts, art, experiences out in the real world.

ERUM: That's awesome. It's absolutely necessary. And Karl and I were just talking about like, how do you explain, grow everything and what, biology is and how that differs from the way things are made today. And I feel like that's something that you're doing quite, beautifully with Gingko Bioworks, and just the way that you've explained, what Grow Everything means to you, that was really helpful.

But what are some things that you say to the person that's not, acclimated to what biology is like? How do you explain biology to them in an easy and understood way?

CAS: I feel like that's the age-old question for people in our space, in the world. Like how do you explain this stuff to people? I always say that it's context-dependent. To me, it depends on where I'm meeting them, out in the real world. And, usually like what's the interaction? but I go simple and use simple language. Because you never know who they are, what their background is, what their level of understanding or familiarity with biology is. and so I usually just say I work at a synthetic biology company. I use that language, almost to be jarring, to be “like, what is that? Those words don't mean anything to me.”

And then that honestly gives me a chance to open up the conversation and be like, oh, synthetic biology is basically just using biology to make things. And I go pretty simple and see what they know by saying things like, biology grows stuff. It grows you and me, it grows all the plants we see outside, all the fungi, all the plants, and animals.

But then I usually switch gears and say, but we now understand, how biology functions, how it does grow, all that stuff. And we can design with that knowledge, and ask different microorganisms, microbes, small little things to grow various chemicals, molecules, materials, proteins, enzymes, for all kinds of stuff.

And usually with a layperson who doesn't maybe have a scientific background or it's been a long time since they engaged with deeper sciences, that will be interesting enough for them. And then they'll just ask what kind of stuff? And I'll give some

examples of cooler, maybe more relevant, partnerships that Ginkgo has, done with customers.

So that's usually how I approach it. But even with people in different industries, I approach it similarly where, at customer organizations, you have people with different backgrounds. so you have people who you can say the words enzyme, protein, nucleic acid, and those concepts make sense.

But then you also have people on teams, even at Ginkgo, where like they're less familiar. It's not their, it's not their background. It's jargon. And so for those people, talking about it in terms of maybe what industry they're in, are they in agriculture, food, nutrition, wellness? Are they in the material space? Energy and sustainability space, pharmaceutical space, not really in the government.

Usually knowing where they fall in the world in that sense, can also help you talk about it so you can, if they're in Ag or they're in food, you can be like, oh there's a lot of cool stuff happening in, synthetic biology related to food. There's of course all the different, alternative protein companies. And there's also traditional food companies who've been using fermentation for a really long time to make various ingredients. So usually it maybe boils down to, get to know the person as my tactic and be like, who are you? What do you do?

KARL: **And I think that's fair. And I think one of the things that we're trying to approach in the recording of this podcast is to really broaden the audience. And we feel like one of the ways that you do that is anytime someone says something that we in this space talk about, on a regular basis, to stop and define it because most people, like you say, they haven't had any biologists since high school. And for them, it's very abstract to think about DNA and how we engineer biology. that's part of this issue of just getting more people involved in this or having more people understand its power is that the common language is still missing.**

CAS: That's why I tend to go the route of just saying biology grows stuff. It makes stuff. Because even that concept is like a leap. Because it's not how we're taught biology, or at least most of us, I wasn't taught biology that way. It was like, biology is this thing off over here that does something. but I wasn't given the viewport to look at biology as this active thing that is constantly making things and taking atoms and combining them.

KARL: **But it is a really simple way to get people engaged, and I really like that. And I think, Erum, we should use that as, when we talk about definitions, I think, like we're talking about having an episode that is like, the definitions to get you up to speed on this podcast, Grow Everything 101.**

But I'm curious in terms of the Ginkgo studio because you guys are doing a lot of different things. what are the most challenging audiences you guys are facing, and how are you overcoming those challenges to communicate with them?

CAS: No audience is challenging. I will say that, sorry, and maybe that's just your turn phrase, but I will poke you on that. Every audience is fun to engage with, and it's like very clear, that this is this audience, here's the channel to reach them. Here's where they are in the world. Here's what they care about.

And so the hard thing for us is speaking to all of them simultaneously. And I say that maybe in two dimensions. We come up with things all the time. Like every single week, there's new ideas. And we have this long-running list in our project tracker called Someday where we just throw ideas and we're like, someday we'll get to that.

That's challenging cause we wanna be speaking to everyone all the time. Because at our core, that's what we do on the studio team. We communicate in various ways. And so that looks like a whole bunch of different projects. But that's hard to do when you're trying to speak to everyone on earth.

Because there's only like 18 of us, and that's challenging just from a project management perspective. And it's, our primary focus is to ensure that the company is successful and helps other companies do great things with biology. So there's trade-offs,

But then the other dimension about speaking to everyone at the same time is something I think about a lot; when we put something out into the world, especially that's not chaperoned by us or we're not standing by to explain it. So when we put a thing out, whether it's our magazine or a video that we make or an interview or a talk, the idea that there's gonna be a whole range of different audiences listening at the same time, or maybe not at the same time, but they're gonna be seeing the same piece of content and are we providing enough like hooks or entry points for varying people to understand it?

That's a huge communication challenge and something like I think y'all do at Messaging Lab, which is to think about there's so many different layers of understanding. And so how write a sentence that makes sense to, a seven-year-old and, a business executive? maybe the seven-year-olds, we don't need to care about as much and we can be making other more fun, interesting things for them. But that's something that I think about a lot.

Ginkgo, at its core we're an R&D services provider to the entire synthetic biology ecosystem. So anyone that's using biology to make something like we look at ourselves as a partner or potential partner to them.

And then we also are responsible to talk to the rest of the world, and people outside the space of synthetic biology, biotech, pharma, genetic engineering, because we recognize that we are a a big voice in this space and have become even bigger recently. And so that, means the responsibility of ensuring that other people understand what we're talking about so they have a seat at the table or voice or, can have thoughts about what we're doing and, communicate them.

And so it's hard to ensure that we're doing the good work of yes, being the business we want to be, but also being like the good stewards in the world. Because at the end of the day, a company is made of people and we care about what we're doing in the world. and so we want to ensure we're bringing along people and allowing them space, so anyway, that creates a challenge to ensure that everybody is on the same page

KARL: **When I think about Ginkgo and the potential customer base, which is very large, it tends to be companies that are doing something that involves biology at some level. And so there has to be some kind of interest, and there probably is some level of education, though they might not understand what the benefit of working with Ginkgo is. Which is what you guys are serving as the conduit, not only to them then to the greater world as you said, but I just wonder like, how often are you guys thinking about, well this particular piece of communications is really gonna work well for people who don't know anything about synthetic biology at all. Is that part of the calculus or is it just something that you're like, those people are not coming along for the ride yet, but they will eventually?**

CAS: There's all of that, all of those considerations. So we have a website, that the URL is just syntheticbiology.com. And so syntheticbiology.com is, the kind of landing place for people who maybe don't know anything or have just heard the words synthetic biology for the first time and they Google it and that website pops up and it's, the content is presented in a bunch of what if statements, what if this could come true? What if this could come true? And the secret is it has already come true. Or it's like something that's being worked on by a company out there.

We do have outlets is the way I think of it as different. Synbio.com represents our place to put content that can engage a really wide audience, with zero to little understanding of the space.

Grow Magazine is another great starting place. Grow Magazine is a magazine we publish annually for anyone listening that doesn't know. It maybe takes an assumption that you do know a little bit about biology, but it's super approachable stories, and really wonderful, and just great to read, like captures your imagination, no matter how much biology you have as a background. And then, I think things we do that are closer to our cell programming work, which is how we describe the work we do for customers. That usually is a little bit farther off from maybe being inclusive to audiences who don't have any biology just because we do need to speak to customers who are super conversant, and experts in whatever particular domain they're in.

KARL: **You said cell programming and Ginkgo is known as being the organism engineering company, which to those who don't know means that basically, the company modifies cells to do certain things or produce certain products. But I'm just kind of curious, like using that cell programming language is always fascinating to me and I don't feel like I use it enough, one of the things that was always interesting about going to Genspace was that there were always several audiences, but two of the major audiences were one artists, so artists who wanted to use biology in their**

art. That was a big audience.

And by the way, I met both of you at Genspace. Erum and I talk about this all the time. I think we met, all three of us met on the same night.

So that was always an audience, was the artists who wanted to use biology. And then you had the computer programmers who wanted to find their next challenge. And so when you guys are thinking about cell programming and I know that the digital tools are a very big part at Ginkgo, do you often think, or do you even think about, this particular piece of content? When we talk about programming, what we really want to do is this is designed to attract more programmers to come to us and talk to us about how they can use their skills in our bio foundry.

CAS: One, shout out to Genspace, bringing people together. Thumbs up. Good job Genspace. We love you.

When I moved to New York City 10 years ago or so, I was looking for community and found these two lovely individuals via Genspace, and a bunch of other great people, who you've probably interviewed. So that's a plug for Genspace, but also more generally a plug for find your local biotech hangout group.

And if there's not one in your area, make one, no one's stopping you, you don't need permission. Karl and I did that with a group of people in New York City. And it's been great.

Okay. Question about programming, cell programming. Actually, I would say when we use the phrase cell programming, we are thinking about, not computer programmers. We're thinking about people, teams who are tinkering around with thinking about actively, playing with the idea of using biology, designing something, taking a gene from here and moving it over here to produce some type of proteins enzyme, small molecule.

That's in our head what a cell programmer is. It's like anyone who is thinking about like, how do I use biology? Or how do I take this functional thing that I know biology does over here and move it over here and, grow it, produce it, express it, in a way where I can then use it for some application? so that's what cell programmer is to us.

It's a new term, but for us, it works. It's a good analogy. Analogies only get you so far, but it's good enough for now, of, basically trying to give a term to the people who are, dreaming in biology,

KARL: So Jason Kelly, CEO and co-founder of Ginkgo, had this tweet, talking about, we have a position for a genetic parts group lead, genetic parts curation. And that just sent me down the rabbit hole for a little bit where I was like, wow,

what are gonna be some of the other positions that arise like that, we're talking about cell programmers, fermentation, something that we haven't invented yet.

CAS: I saw that tweet too. and I loved that because I think Jason was poking at the origins of him and the other four founders was essentially like a parts curation, and that's where like the BioBricks idea came in as well, that Tom, instituted and is, underpins iGEM.

Transition

KARL: BioBricks are DNA sequences that follow very specific assembly standards. Think of them as building blocks or legos that can be put together in different ways to assemble larger synthetic biology circuits that together have a unique function. Those circuits can be Ginkgorporated into living cells such as e. coli to construct a new biological system that produces a specific product or carries out a specific behavior.

Trasnition

CAS: Obviously we have people who already do that at Ginkgo, but clearly there's a need for a lead right now. So join the team. Always a bunch of open positions. So check it out.

ERUM: It'd be interesting to hear what other types of jobs there are at Ginkgo and for our audience to learn about, maybe there's something in biology where they see that they can be involved in based on what talent they have and what talent like a company like Ginkgo needs or has?

CAS: Sure. Happy to. let's think about what is Ginkgo. it's a large organization of people. we're broken up into, a few different big groups or divisions.

There's a commercial team and there's a technical team. So like the technical team you can think of as raditionally like scientists or engineers or other various domain experts. Commercial team also has those individuals, has scientists, has engineers, but has people with no science background, has people with business backgrounds or, legal backgrounds or administrative backgrounds or, others, like facilities, background. In terms of designing and building out our facilities, but also operating them, managing them, critical.

Biology is a physical business. It's not fully digital. And so there's a lot of logistics to get our work done. So there's a really nice, sizeable team of lovely individuals taking in items, processing them, stocking them in the right place, ensuring that our technical team, the R&D labs have all the materials they need to run the experiments. And then we have the whole digital tech division. And that's made up of people who are experts in hardware, who are experts in software, who are experts in creating and building upon the various products we have at Ginkgo.

So when I say products, I use that broadly. we develop a lot of our own software internally. And then like on our team, we have graphic designers, people with art as their background, writers, communication experts as their background.

So it spans the gamut. So definitely don't think you're not a part of this space, if you like, don't have a genetic engineering background. not true at all. If you look me up, you might see I'm like a bioengineer in material scientist, but my degrees are coming from left field, because I grew up in Louisiana where the curriculum did not include synthetic biology. There's a lot of space in this big bubble we call synthetic biology.

KARL: When it comes to the studio and the roles that you guys fill, because you play a very key role in this organization and also in synbio writ large to the world, what are the positions that you see that have been hard to fill? If you could wave a magic wand, who would be the three ideal people that you would bring onto the team?

CAS: Certainly anyone that can translate between audiences or go between different types of people and be able to communicate or exchange ideas and synthesize new thoughts into something more complete. That's a superpower.

Because, it requires your brain to juggle different domains, and different language. and also then come out the other side with clarity on all of it. so that type of person is awesome. and so that could look like, a straight-up, communication expert, but it could also look like someone who is focused on visual design or graphic design or like how do we structure these ideas visually, so that they make sense and people can follow a narrative.

Because everything we do, even if you're not on a studio team like mine is constructing narratives, right? That is what communication is at the end of the day. So even if you're a business development person, a sales team person, or whatever, it all relies upon, being great at communicating.

And I think, we are, the people on our team and I can maybe speak for Christina, who's my boss by the way, but going back to the, like we have so many people we want to communicate with and to, and what I can probably speak on Christina's behalf and certainly my behalf is we're fanatics.

Totally, like just wake up and every single moment we're thinking about synthetic biology and we think about it in our spare time, talk to each other in our spare time about it, dream about it. So like our day is just filled with communicating internally, and externally about synthetic biology. And that has some, outcomes that you're describing.

KARL: **You said you guys, you're waking up and you're, dreaming about synthetic biology. You're thinking about it, and you're having these discussions as we've had. So tell us some of your dreams about synthetic biology. I mean, Erum, you should ask this question because you're the one who said,**

ERUM: I'm always curious because I took a step out of the biotech world and when I was in it, it was primarily pharma. That's where all the action was happening. , and then I left, but now there's so much more, happening and like I'm starting to dream up a bunch of things and I just came back, you've been living and breathing this for quite some time.

So I'm always curious to know, what are you thinking about? What are you excited about? if you had another life and you could have a startup, like what would that look like? What would you make?

CAS: That's a good question. I don't often ask myself that. But I do have an answer for you. And Karl's probably heard me say this before. What I think about a lot, what I dream about a lot is actually, the idea that we're such a small group of people, comparatively to the 7 billion, 8 billion people, or whatever the number it is today out there in the world.

So we're such a small group of people that our brains, our minds have been open to this like, wow, biology is something you can use to create things and use to solve problems. So what I dream about is the idea of opening up or like flicking the switch on so many other brains and what would they dream up?

Because I've been in this space for a decade now, maybe a little more. I know who I am, I know where I am, I know my utility and purpose and value to this movement, and like to Ginkgo in particular. And I think part of it is like my awareness that so many other people have so many amazing ideas and they just don't know that they have the ideas yet because they've not been introduced to this.

So that gets me excited and is like one of the reasons I love working at Ginkgo and in particular the team I'm on. It's like we're able to think about those people and that's why we do make broad audience-focused content or cultural artifacts to, resonate with people.

So that gets me excited. And certainly being all of us are in the New York City area. I just think about our hometown, there's 18 million people in the metro area and How many people do you think really know about synthetic biology?

KARL: Less than 500.

CAS: That's crazy!

KARL: So here's something crazy, just as an anecdote. I went to a VC event last week and met four new VCs two that had just moved here, and then another one who's moving from London and they're all here to invest in biotech. And I was like, that's a really good song,

CAS: That's great. But I think about like, all the school kids and the New York City School program, doing one thing that gets into classrooms would be amazing. And selfish plug, another division at Ginkgo's focused on biosecurity. And so we had a really big focus during Covid-19 and testing at scale for schools across the country. It was like K-12 testing and so we were like, oh, cool. Like it's access to these teachers and parents, and thus like students to be able to give them stickers about biology.

And so we sent, oh God, I wish it's on the back of my laptop if I cannot rip the camera off and show you. But I created these great stickers with the team, that are just like super cool looking. And the subtext is like they're biology. And it's like a kid would look at it on their folder and maybe four years from now they'd be like, oh, I know what that is now. That's like RNA. And so that, gets me excited. And then I'm gonna grab some artwork.

We also do fun things like these little cards are illustrations that we had made, with an artist that we love over in France. And like each of these big things is like an organism. This is aspergillus. But it's like this other world where microbes are not micro, they are big. And the idea is in this alternative universe, like what if biology in this form, microbes, were huge and people interact with them all the time and they're like, part of our culture, part of our religions, part of our social structure.

Like how would we interact with them? What would we know about them? How would our world be different? I point to that because it's a product where it's still in its early exploration days, but we see that as like a great way to put that out into the world for kids or teenagers or college students. For them to have that flip switch.

KARL: **They're basically, trading cards for microbiology.**

CAS: Yes. So to go back to the question, like that's a dream I have of I wanna do that because I want to help other people dream in biology because I think their dreams are amazing. I remember there was this tweet, I forget who it was, but it was like, their child was like, oh, wouldn't it be cool if when it's raining, our umbrellas were able to show us the different microbes and the raindrops as it hits the umbrella sheet. And it would like, light up different colors or something. And I was like, that's cool! I never would've dreamed about that. And that's why I think I'm excited about like helping other people dream about it. Because that's like some, seven-year-old's dream just randomly while they're walking in the rain.

KARL: **that's like a very advanced seven year old.**

ERUM: **That's why we need seven-year-olds. Seven-year-olds are important to talk to.**

KARL: I always try to do one career day, at Millennium High School in Brooklyn where two of my sons have gone and I did a, "What's your Bio Strategy?" Kind of presentation where I start talking about growing your phone and the questions were the best, like they're, uninhibited challenging just questions that none of us would ever ask each other no matter how hard we tried because we already have too much experience and have filtered so much.

But just like the hardest questions. And my answer was, I was like, I don't have an answer for that. That's something you need to figure out. Even like the ethical stuff, they're like, do these bacteria wanna be engineered? And I'm like, there's people talking about that. we need people who are answering those kinds of questions. You should go do that.

CAS: That's cool. I love that.

ERUM: Organism ethics!

KARL: It's like a branch of bioethics. That's something we have to bring up with Megan Palmer. We're gonna ask her about that organism ethics because in the last volume, of Grow Magazine, there was something about killing off the organisms that you had engineered.

There was like this whole, I don't remember who the author was, but I could feel her pain and she was feeling pain, and she was like, can I do bioengineering without having to kill all these microbes? Should I feel guilty about that? it was fascinating to think about it that way.

CAS: Besides the philosophical or ethical perspective, we have colleagues who are doing that, right? Solugen is think a good example of doing cell-free synthetic biology is what I would call it. Where it's just like enzymes though, like, those enzymes have to come from somewhere.

But I'm now scratching my head about what would my startup be if I did a startup. I feel like honestly like two things that are bothering me right now in our area of the world, spotted lantern fly. Come on, there's gotta be a biological solution. Come on.

KARL: Tell your spotted lantern fly story please.

ERUM: I saw one on my balcony here in Brooklyn, my little balcony. I wanted to sit outside, but it was there looking at me in the face on my chair, and Karl told me I needed to stomp on it, but I didn't have sneakers and I didn't wanna stop on, stomp on it and get guts all over the place and clean it up.

So I was like, how can I just kill this fly? And then two more showed up and I was like, uh oh? I'm like, now they're like ganging up on me. And then my son like picks up stuff

in the park. He picks up one and brings it to me. I'm like, what is that? And I was like, is that a flower? Cause it's red and I'm like, "No!" and I smacked it outta his hand. So lantern flies. I will invest in your startup.

CAS: Huge Ecological toll, right? And I don't know if you've noticed this, but, lots of trees in our area are being affected by various fungi that I think I've heard my little local arborist mention, or at least his hypothesis is—I don't know, I'm not a fungal expert, but it's somehow tied to climate change potentially. Because it's warmer, wetter for more parts of the year. Unclear if they're like a normal part of the ecosystem, but, I know in my area like every other lot, two weeks will go by and another tree will have to be cut down.

And so that's concerning to me. So it's like there's one that's probiotics for trees, which like, that's gotta exist, right? Someone has to be doing that.

KARL: I don't think so. As far as I know.

CAS: But then on the flip side, the same arborist was like, these fungal strains are really fascinating because they move really quickly and they will like essentially degrade a tree in a month's time. And I'm like, whoa, that's really cool. Enzymatic capabilities that could probably be applied elsewhere.

KARL: We've been doing work with an organization that's really focused on domesticating microbes is what we'll say at this point. And so talking about growth and how quickly they grow is actually super interesting. I have a tree in the backyard, a plum tree that has one branch that is covered with a weird fungus. And our arborist told us to spray oil on it or chop that branch off. But I haven't noticed it as much. Kristen's the one who noticed it when she was hiking early in the spring.

There are certain parts in the Adirondacks where there are just so many moths. And like they're saying, all of this area is just gonna be completely devastated by climate change. The trees are just not ready for it. It's like you say, it's too moist. They never get a chance to dry out. The root systems are gonna be just constantly wet. and then you have this change in temperature. So it's a perfect breathing ground for strange fungi to appear.

CAS: Fun guys. Yeah. So anyway, those are two things that.

ERUM: going off of that, what are some of the companies that you work with at Ginkgo, can you speak on some of the companies that both in the biotech space, but are you working with, companies that aren't in the biotech space and getting them to think about, using engineer organisms.So I'd love to know more of the outcomes and like what kinda activity has been going on in Ginkgo.

CAS: Sure, I can list names that's easy, but maybe before I do that, the way I bucket different organizations is there's like a clear, "do they use biology today?

do they do fermentation? Do they do genetic engineering? Do they have a strain of something that does something that they're actually growing or no, they don't?"

And so that's the easy way for us to categorize like, are they a certain type of customer that can use our services today? Or are they a customer that needs help understanding that biology could be useful to them? And there's a spectrum there. Like some companies are right on the cusp. Like they're about to jump into the mix and they're like, we buy cultured ingredients from, ingredient suppliers, but there's many different reasons and they're like, we wanna do it. We wanna get into the game. We're like, okay.

Or there might be companies that do fermentation, but they're just using off the shelf, strains of something that's supplied from some supplier. But they've never thought about, "oh, like we could tweak that strain to, decrease our manufacturing time or increase the amount of product we get," whatever.

And then the spectrum goes on from like people who are much, much further down the chain and have never thought about making what they currently make with biology. but you can go to Ginkgo's blog, or our press page and just see a huge list of, company announcements that we've worked with.

But we work with all kinds of people. So we're working with Bolt Threads, we're working with Huue Bio. We're working with more traditional kind of like pharmatech companies. So Merck is one we announced recently. Aldevron is another that we've worked with.

KARL: There's Sumitomo, the big Japanese chemical company.

CAS: Yep. Sumitomo Chemical. Bayer is another one. That's a great partnership that I think a couple of months ago we announced that we're gonna be even doing more work with them. Roche, Biogen, Moderna. In the foodspace, Cargill Care, all kinds of different companies. ADM, that's another AG Foods one.

ERUM: Can you speak to like, the application, like what specific projects that you work on for the audience?

CAS: Yeah, yeah, yeah. Happy to. I'll just go back through the ones I named, bolt Threads. They have a number of different products, so we're helping them, with their personal care application. Which is basically, bolt uses microbes to grow, basically, silk. So spider silk, but without the spiders. But they, pivoted one of the use cases to be like some type of personal care ingredient. I'm not exactly familiar with the end products, but you can buy it and so on if you go look up Bolt Threads and personal care, maybe some type of moisturizer, I wanna say.

KARL: Apparently it's very good. I remember hearing from early users that they had never used a moisturizer that was as good as the one that Bolts was supplying. So I don't know if that's what's on the shelves now, but I just remember people, speaking very positively about it.

CAS: And I think their brand name is B Silk, like just the letter B silk. So that's one. Huue bio. That's H-U-U-E Bio. They are, making different dyes like pigments, for the fashion industry, I think is their current focus. And their first dye that they're focused on is indigo. So that's the pigment that people, traditionally use to make blue jeans.

And we're helping both Bolt and Huue, it's the same story, they have a strain, a cell that already grows these products and we're, working with them to try to improve their cells, in various dimensions. And so they came to the Ginkgo platform because our services basically are like a perfect fit for them—they have an existing strain, they need to improve it.

Rather than them investing a bunch of time, money, effort, and people into trying to build out facilities to do it themselves. They looked at Ginkgo's facilities, basically like a great external partner that they could use.

ERUM: Imagine pharma, how do you, um, work with pharma?

CAS: Yeah, so, Merck, that was one we announced recently, so we're working with them trying to create or improve, enzymes, so an enzyme is just the type of protein, enzymes that can be used to produce different, what's called active pharmaceutical ingredients or APIs. And so APIs are the active ingredient, just like it's in the name, of medicines that people take. And a fair amount of active pharmaceutical ingredients are made, just straight up chemical synthesis. So chemical engineering, chemistry. But it turns out biology is actually really great at doing that. So rather than, using traditional chemical synthesis, which is just straight dependent on chemicals, heat pressures, and time, you can use biology.

And so enzymes are these little tiny globules of protein that, are basically like, little puzzle sorters. So they'll take in atoms or molecules, chemicals. And reconfigure it into the shape that you want. And so there's a whole, many classes of enzymes that people call biocatalysts; of course, just the word to mean speed something up.

And so we're helping them, basically engineer or design new enzymes that will be used to make these active pharmaceutical ingredients instead of, using chemical synthesis. So the idea there is it'll be, more cost-effective to use these enzymes or, potentially these enzymes could allow them to create new things, that they weren't otherwise able to create.

Because biology is really great at creating complex, stuff, so molecules. Whereas it's much easier with more traditional chemical synthesis to do more, let's say simplistic, molecules. You can of course make things that are fancy, but it's harder because you just have less control.

So that's one. then Aldevron was another one I mentioned. So Aldevron's a great company there working on, there's a, basically, for, vaccines ,mRNA vaccines. There's a thing called a capping enzyme is what they call it. But basically it just makes it, play nicer in your body and so it absorbs better, integrates better and provides you with better health more easily, let's say. And so this is an ingredient in mRNA vaccines.

But no one has good ones, basically. They're just like everyone knows, they're like so meh. And so we're working with them to make new ones, that are better and more friendly to the human body. So it would both make the experience of getting a vaccine better in some dimension for the person who gets a shot, and more effective is the goal or the hope. So we're working with them to design new ones.

I mentioned, Cargill and Carrie and ADM, these are really big companies that you probably consume, products that they've grown in some dimension. But they use enzymes all the time, to do, different processing techniques. So turn agricultural product into food, that tastes good and is nutritious. And so we've helped, those companies produce different enzymes or improve their strains, in various ways, for different ingredients.

KARL: **Cass, is there anything that you wanna talk about that you haven't had a chance to?**

CAS: I think my question is who are we hoping to reach with these episodes?

ERUM: **Of course, trying to reach the broadest audience as we are going to promote this to our network, which of course are going to be you and the, you know, other people in the biotech sphere, because we wanna make it accessible. And for example, I would love to share this podcast with people that are not in the biotech space but they are entrepreneurs so they can understand what is going on in the biotechnology industry and how it could be applied to their worlds.**

So the non biotech people is the end goal, trying to get them to start understanding that this is a technology that they can use in some capacity, perhaps. Most likely yes, because if you can grow everything, then they can be challenged to think about how can biology be used?

CAS: Cool. I will gladly share it with all types of people because we have people coming to us all the time. Whenever I talked about the different buckets of kind of people out there in the world using biology or not yet. Like that bucket, not, that isn't using it yet. there's plenty of people in there that are like, teach me, educate me. And so that would be an awesome resource.

ERUM: We have lots of different founders too, like the founders of Polybion for example. So people understand not only what they make, making leather out of, fruit waste, but like how they're doing it and they're manufacturing in a sustainable way. They use solar energy, they use recycled water. just their whole approach is beautiful.

CAS: So I've thought about this as well, like, how do you get people solidly not in the biospace, or like without a biological background, let's call it, to view the world through the lens of what could biology do?

The way I've thought about it is would it be useful, and I'm giving this to y'all as like a scratcher head chew on it. Like literally to just go around your house and look at every single item or interaction you have. Like I'm looking at my table in front of me and it's what could I point at that a person would also likely have in their home that I could be like, biology could do X or Y or Z, or A, B, C?

So it's okay, like a pen. It's like the polymer that this pen is made of was made from fossil fuels and that's bad. And like when they throw it away, it never degrades. That's bad. And the ink inside is made from carbon black that's bad, and comes from combustion of fossil fuels, right?

And so it's like all of that could be replaced with a biological solution that like, oh, this doesn't work anymore. let me throw it in my yard and it'll feed my, plants or something. Or like I have a water mug and it's ceramic, but it's got some plastic. So same story there, but then white pigment. Where is this white pigment from? Could biology be making that pigment? And then, random food wrapper thing, and it's oh, this is gonna last a thousand years.

KARL: No, it might not, there's a lot more wrappers that are biodegradable than we think.

CAS: I love that. I have a base of flowers in front of me, and I was like, okay, flowers are already biological. That's cool, but that's a really cool space that people could be exploring. like I've been battling the water in this vase for the past week to try to keep the flowers alive. So I would buy a product if I could like, dump a little probiotic mix that's not the crappy, like “here's some sugar!”

It doesn't explain jargon to people, but it at least maybe helps them look at their world in a different way.

KARL: I think it's a great idea.

CAS: Like you could do it almost as like a game where you ask each of your interviewees, I'm gonna give you 10 objects and you have to tell me at least one thing for each object, where biology could make part of it. And like they increasingly get harder. Because you begin to reveal biology at the atomic scale has the ability to move

atoms and like rearrange atoms and manipulate matter. And that is, a core thing to understand. Biology moves stuff around and reconfigures it and like literally makes magic like my plants are magic because they're just like taking the air in and making themselves. Fascinating, right?

A tree doesn't grow from the dirt, A tree grows from the air. What ? I would love if y'all riffed on it and came up with an even better idea, but that's something that, I've thought a lot about, about like, how do you help people without making them take a biology class, understand a functional aspect?

ERUM: I think the examples are the best, coming up, the start ideas, like you're saying, we use the word biologize, like how do you biologize a pen? That's going to be, good way of helping people visualize what's possible.

They wanna know that there's sausage, but not necessarily how the sausage is made, right? They wanna know like what flavors of sausage are out there or other needs, some people are curious enough that they would want to know, okay, how do you like sequence a genome and do all these other things? But some people just, they'll take a word for it and they wanna know what's possible, .

KARL: Totally. I think that is the perfect place for us to end, this particular conversation. Cas it's been a huge pleasure to have you here. Like I said at the beginning, you're a friend of the pod and, this is the first of many of your appearances. This has been a fantastic conversation.

CAS: Cut!

ERUM: End scene !

Transition

KARL: Wow. That was a great interview.

ERUM: Very great interview. Cas is a friend of ours who knows what's going on on the inside. He has a great imagination. He sees so much like what is going on in Ginkgo, all the different companies that they work with. I just love to be a fly on the wall.

KARL: One of the things that, that conversation makes me wonder about is, we often use and this is the easy way to talk about synthetic biology and biotech is to use computer analogies, which to a certain point work, but at a certain point what's gonna end up happening is people in the IT space or in the computational space are gonna start to use biology as the analogy because it's actually a lot more powerful than talking about programming cells.

ERUM: When he says,dreaming in biology, right? That's a fascinating term and I'm sure software engineers dream in code, right? I actually, had this crazy dream, where I was just, completing an Excel sheet because I was just working so much and I'm like, wait, what? Why am I dreaming in Excel? That's sad. It happens when you're really, focusing on getting something done. The brain works in mysterious ways. But I love that concept, just dreaming in biology. And I feel like the more that, we venture into. the world of biotech and see all these different companies and, you and I always think of different startups. I'm sure know, we'll have dreams of biology. It just hasn't happened for me yet.

KARL: Don't feel bad. I've not dreamt in Excel. I have dreamt in Tetris.

ERUM: Oh, what?

KARL: Yeah. I think actually I don't think that's uncommon if you play Tetris a lot. I think I've heard that a lot of people start to see those little bricks falling down into the shapes as a dream.

ERUM: Oh my gosh. And when it clears, ah, I bet there's some type of ASMR like Tetris video where like it clears and it's like, ah.

KARL: Yeah. Just the relief.

ERUM: Yeah. And then in this episode, I liked how he talked about communicating to a broad audience. They are this big behemoth of a synthetic biology company and they wanna really set the stage, set the tone to the global audience.

And then also cross up on ages. Cas talked about trying to appeal to a seven year old. And what does that look like? I think that, is very good to do that because it is introducing, really fundamental concepts of biology. If you don't have a biology background, it's good to get that, basic information that you need. And, I think at seven years old is when you start learning about science.

KARL: No, I completely agree. I am very impressed by the way that Ginkgo talks across multiple audiences and the fact that they're thinking that's something they need to do. It just made me add that to the checklist for when we are helping our clients talk to their own audiences.

It's important that they realize that they're just not talking to that one audience. There's always multiple audiences that are being spoken to.

ERUM: Yes, absolutely. Great. I also wanna give a special shout out to Linda and Tony for their comment on Spotify. They perceive that we have a very fascinating podcast. So thank you for that. More people should comment, on Spotify or send us an email.

KARL: That sounds great. Yeah, leave your message and, we will respond. Thank you!

ERUM: See you guys later.