

DOPE LABS

Transcript of Lab 019 ____

Zakiya: I don't judge. But the Internet does. The Internet says the worst people are somebody that's doing cross fit or someone who is vegan.

Titi: Let me guess...I was gonna say "let me guess, vegans.".

Zakiya: Yes!

Titi: Honestly, I feel like nobody loves talking about themselves more than vegans. I have nothing against vegan. Whatever you want to eat, eat that. That's fine with me. But they love talking about being vegan.

Zakiya: A lot of posts out there about being vegan.

Titi: Yeah. There are some aggressive vegans though that are like really mean if you aren't vegan. And those are the ones that I'm just like, OK, well I'm going to just keep my distance because I don't want no smoke.

Zakiya: Well, I got to tell you, I had an impossible burger recently, and you might have to keep your distance from me. OK?

Titi: you're gonna give me some plant based smoke.

Zakiya: Yeah. You're going to get these wood chips. OK.

Titi: I'm Titi.

Zakiya: And I'm Zakiya.

Titi: And from Spotify studios, this is Dope Labs.

Zakiya: I am all on the planet based meat alternatives kick. OK.

Titi: Yeah We want and got that impossible whopper and tall of a sudden Zakiya is soy everything. Soy life.

Zakiya: That's not true.

Titi: Im like "what are you eating?" "oh this impossible meat" and I'm like "mmm..Well, what are we going to do for a function? Because everybody can afford to..."

Zakiya: No. OK.

Titi: hot dogs.

Zakiya: That is so funny because I posted the other day that I was in the grocery store and I saw some of the Beyond like the beyond crumbles that you can get. And I posted it on Instagram. And my friend Kate wrote me and said, "is that what you're making the turkey out of? Is that what you're doing?"

Titi: Because we have friends giving at your house. Right. And so, yes, if I would have seen that, I would have been alarmed, too. But we didn't have that. Yall, we had a lot of really good.

Zakiya: This has almost become a food podcast.

Titi: I know we got to change the category.

Zakiya: But, you know, I got even my dad, I got him eating plant based.

Titi: Uncle Curtis is eating.... Let me tell you,.

Zakiya: That is a meat eater.

Titi: Uncle Curtis he can eat six chicken thighs in one sitting.

Zakiya: It's true.

Titi: He's very tall and very strong and he is powered by chicken thighs. He is going to kill me.

Zakiya: He is going to kill you. So when you think about taking someone like that and I don't know what his carbon footprint is.

Titi: Paul Bunyan, carbon footprint.

Zakiya: We take someone like that. You say, all right, I got this person to eat plant based meat alternative, something. You're doing something different. He's not going to eat a Boca burger with no shade to Boca Burger. I like those too but he's not going for it oK. I got him that burrito bowl at Qdoba. He said, "hey, you tell me this right here. This is all vegetables. Im in, I can do it."

Titi: He is going to be at Qdoba every day. Even Oprah. She did a 30 day vegan challenge, right?

Zakiya: Right. See, we're on to something you have to follow in the footsteps of the greats. Yes. Oprah Beyonce.

Titi: *Oprah impression* Impossible meat! you get a burger, you get a burger, you get a burger.

Zakiya: That was Titi.

Titi: I thought that was an all right Oprah impression.

Zakiya: I thought it was good.

Titi: Well, you know what can perfect to this Oprah impression is if I meet Oprah. Hey, Oprah, love to meet you.

Zakiya: And I'd better help you with that.

Titi: Yeah, I'd meet my friend there.

Zakiya: OK. So I think this episode we need to put.

Both: Meat alternatives.

Zakiya: Under the microscope. So let's get into the recitation. I want to know, has anyone out there tried some version of this? I mean, is in our local fast food establishments, so it's at Qdoba that I know about, where else?

Titi: Burger King,.

Zakiya: Burger King.

Titi: I saw that KFC was trying to come up with a plant based chicken.

Zakiya: That seems tough and I feel like this is coming out of nowhere.

Titi: Yeah. It went from...

Zakiya: 100 percent Angus beef.

Titi: Yeah to pea protein.

Zakiya: Very quickly.

Titi: Yeah. Me, I just want to know like, how is this stuff made? What? I don't really understand how you can make pea protein sizzle on the grill.

Zakiya: Yeah. How is it made? is it better for you? Because I know people think like, oh, if I get this, this is a healthier option.

Titi: Is it?

Zakiya: Is it? And then not only is it better, but like what kind of technology is a 3D printing these burgers? I want to know the how. Because I know it's not like we harvested peas. You know, when you get a veggie burger, you can see it like a little bit of it. Here's a little bit of carrot. Here's a little bit of pea. Yeah, a little onion, a mushroom over here. It's not like that.

Titi: Not at all. It looks like meat, this thing, even some meat. It has like stuff that looks like blood.

Zakiya: Pink, too. Dark brown. What's happening?

Titi: I don't get it.

Zakiya: And so we want to get to the bottom of it.

Titi: Let's take a big bite and jump into the dissection.

Zakiya: All right. It's time for the dissection. We invited Dr. Christina Agapakis to help us unpack all of our questions behind plant based meat.

Dr. Agapakis: My name is Christina Agapakis. I'm a synthetic biologist and the creative director at Ginko Bioworks.

Titi: Ginko Bioworks is a biotech company that was founded in 2009 by a bunch of scientists from M.I.T. Earlier this year, the company launched a new venture called Motif to find the next big thing in laboratory based food. And they did this by developing the key ingredients using biotechnology and fermentation. But before we dive into the science behind all these plant based meat options, we wanted to zoom out and get a little bit more familiar with the history in the industry of plant based meat. Plant based meat is nothing new. But we are in sort of a renaissance period where it's becoming way more popular. I see these plant based patties everywhere and chances are you can find them in your local supermarket in the meat aisle. Back in April, Burger King announced their new impossible whopper. And McDonald's is actually working on their own version of a meatless burger alternative.

Zakiya: The plant based meat industry has grown so much over the past, I don't know, five to ten years.

Titi: Yeah,.

Zakiya: You know, I remember seeing like Morningstar Burgers and stuff like that in the frozen aisle. And every now and then I get a black bean burger. I even tried to make my own black bean burger. No good. But, now that this is it, Burger King and all these other places and in the

grocery stores like have we reached a peak? Is the growth going to slowdown now or are we on a trajectory to just keep going?

Titi: Well, analysts expect that the plant based protein or meat alternative market is going to grow by 28 percent a year from four point six billion dollars in 2018 to eighty five billion dollars in 2030.

Zakiya: So 28 percent of growth each year between now and 2030.

Titi: Yeah.

Zakiya: What?

Titi: I need to buy some stock.

Zakiya: Yes.

Zakiya: The next episode will be about....

Titi: The stock market.

Dr. Agapakis: It has been really incredible to see that change in the way that people kind of talk about vegetarian options and vegan options and and how much demand there spend. It's been really, really dramatic.

Zakiya: And there are a bunch of different reasons people are gravitating more towards plant based meats.

Titi: Right. A few years ago, I feel like people didn't eat meat for two main reason animal rights or for their personal health. Like they wanted get their cholesterol lower or whatever. But Dr. Agapakis says there's another reason why it's become more popular.

Dr. Agapakis: Climate ethics and environmental impacts that you have is a major factor. I think that in many people's decisions. And that's been something that I think has changed pretty dramatically in the past few years where where people look at the sort of impacts of their everyday things that they do and they see meat coming to the top of the list and they see better options for them for for things that still taste good that they can have access to that can can start chipping away at that impact that they have as an individual.

Titi: So the demand is growing dramatically for different reasons. Let's talk about supply. What are these meat substitutes actually made?

Dr. Agapakis: It's basically like a protein that comes from plants. Right. And so there's lots of ways that that can happen.

Zakiya: That's right. There are many different kinds of plant proteins, though. For example, Garden Burger, which was invented in the early 1980s, uses soy protein in its burger patties. And those patties came with like those grill marks. So you felt like really grilled.

Titi: What is that?

Zakiya: But also, peas, wheat, nuts and rice are popular crops that are used as meat substitutes. But a lot of those earlier meat substitutes didn't quite hit the mark.

Dr. Agapakis: You can do a lot with the texture from the proteins that you can get from plants, but you can't really do everything that a meat or dairy products does. You can't get the full sort of sensory experience. You can't get the kind of qualities, whether that's like how it foams, how it feels in your mouth, how it cooks. All of those things might have different kinds of ingredients that come from the meat that are important.

Titi: So while a lot of earlier meat substitutes tasted just fine, there was no way you could ever confuse them for the real deal.

Zakiya: Yeah,.

Titi: Especially with those fake sharpie grill marks.

Zakiya: So that really brings us to why plant based meat alternatives now are becoming so much more popular. So let's use two of the most popular plant based meat companies as an example. Impossible burger and beyond meat. Both companies still use plants and grains for the bulk of their protein. Impossible uses soy protein concentrate and beyond meat uses pea protein.

Titi: But what makes these so different from Garden Burger is the specialty ingredients their scientists have developed. These ingredients are used in much smaller quantities, but are actually what makes the product look taste and smell like real meat. In other words, these ain't the old school veggie burger patties.

Zakiya: Whats an example of one of these specialty ingredients?

Dr. Agapakis: For impossible foods that was the heme.

Zakiya: Heme has been referred to as the magic ingredient in the impossible burger.

Titi: So heme is the stuff that makes Impossible burger cook from pink to brown, right? Just like a real burger. So what is heme for real for real?

Zakiya: Heme is most commonly recognized as one of the components in hemoglobin. Right. And that's what makes our blood red. And its primary function is to just transport oxygen. So scientists at impossible use heme to give their beef patties that meaty flavor.

Dr. Agapakis: And so being able to find a source of that protein that's vegan was really important to the team at Impossible Foods and is really a key ingredient for them.

Titi: So how did the scientists at impossible use him without using animals as the source for heme? That seems really tricky and confusing for me.

Zakiya: When we tend to think about heme people always go to the example of hemoglobin and hemoglobin being in blood, but the thing to remember, heme is also present in plants and is present in one of our favorites, Soy.

Titi: We're going to take a quick break, but when we get back, we're going to dove into the actual process of finding and extracting these proteins that are then used to make the magic ingredients in our plant based food.

Zakiya: Stay tuned.

Titi: We're back and we're ready to dove into the actual process of engineering, these plant based proteins that ultimately become your impossible whopper. As Dr. Agapakis says, it's an incredibly multidisciplinary process that involves aspects of biology, chemistry and genetics. My friend Zakiya is lighting up.

Zakiya: It is a wonderful symphony. Right. In order to get a plant based burger, patty, just right. Scientists have to go through a lot of trial and error looking for the proteins. That have the best qualities.

Titi: And before the break, we found out that heme was the key ingredient in making impossible burgers. Red and juicy, just like real meat. You can find him in soy, but only in small amounts, and so extracting it from the soy would be really, really inefficient.

Zakiya: So the scientists at Impossible knew that they couldn't just pull the heme straight from the soy that would kind of cause a lot of problems. So they figured out a way to make their own heme.

Dr. Agapakis: The way that they do that is actually sourcing the gene for plant hemoglobin. So like the protein that binds iron and blood is also used to bind iron in plants. And so they took that same gene and then transferred into yeast. And now yeast can start making that protein at high quantities and then that can be used as an ingredient in the food.

Titi: OK. I need to break this down a little bit. First, they find the gene for the plant hemoglobin. Where do they find that?

Zakiya: So in the 60s and 70s, scientists used to use a very manual process to break down genomes. So remember, that's all the genetic information in a plant or in an organism into these tiny little pieces. And then to say which of these pieces has the thing I'm interested in that took forever. But now with Al Gore's Internet...

Dr. Agapakis: Now I just go to my computer and type like I want the gene for insulin and there it is. I can actually search those databases now and say, like, I want to hemoglobin gene. Show me all of them. And like, here's a few thousand.

Titi: This has really widen the pool of potential genes when it comes to sourcing for plant based proteins.

Dr. Agapakis: When it comes to sourcing those genes, it's all of biological diversity. Right. Like those proteins can come from any kingdom, any organism. And because of the the how much people have sequenced and how much sequencing is out there, there's you can source those genes from almost anywhere now and be able to access that diversity and learn from it.

Titi: So let's say that you've scoured the database and done a bunch of tests and you found the gene that produced the protein you need to make the perfectly juicy meatball. Then what do you do?

Dr. Agapakis: We can take those sequences that are on the computer, the digital sequence of the DNA code and synthesize it into actual chemical DNA that now the yeast can read and start producing that yeast now is a factory that copies itself. And in a tank that looks like a brewery tank sort of facility and you could have trillions of each of these cells, each making their own. And so that's where you can actually get to that level of tons.

Titi: This process is called recombinant microbial technology and it's the ability to take genes from one source and put them in another organism or plant.

Dr. Agapakis: You change the sort of supply chain, right. So now instead of having to grow a ton of crops to squeeze out the tiny bit of hemoglobin, you make something that makes tons of sugar. You put that into the organism that's transforming that sugar into that protein.

Zakiya: This is really clever. Like I don't think we appreciate what scientists are doing here enough. And I'm not just saying this because biologists do it.

Titi: break it down for the people, Z.

Zakiya: If you have a gene that you know, encodes for a protein and that protein is only made in small amounts, you have to take so much of this source material to get enough protein to be useful. You know, many soy plants, we would need to get enough heme to make blood for Burger King, supply of burgers. A lot of plants. So instead you take that gene and you say, I'm going to use something that can grow really quickly, turn over really fast, won't really damage the environment and use that to produce the protein I want.

Titi: So that's the yeast.

Zakiya: They use yeast. So you can use microorganisms which are really small. You just got to feed them some sugar. You know, a little bit of salt, some amino acids, add some water and they're happy.

Titi: That sounds like how I make cinnamon rolls.

Zakiya: Oh, well, I would like to that you are using yeast in your cinnamon roll, right?

Titi: That's what helps it to puff up.

Zakiya: Yes. Because they're releasing gases. That's what makes your dough rise. Don't even get me going. So imagine you have huge vats of these bacteria or yeast. However, they're doing it, producing this protein. And then you have a, a way that you can select only the protein and none of the other stuff is left behind. And so you just have pure protein.

Titi: And a bunch of it.

Zakiya: A bunch of you can make those burgers bleed and sizzle on that grill, baby. Meat tastes. *snaps* just like that.

Titi: And what really surprised me is when Dr. Agapakis told us about this recombinant microbial technology process and the fact that it's been around for a while, she gave us an example.

Dr. Agapakis: One of the most sort of important and kind of classic examples of this is how we used to get insulin. So insulin for diabetics used to come from the pancreas of pigs. And like the one of the earliest applications of exactly that recombinant technology, the ability to take genes and move them around and start thinking about them as as these different kinds of machines that can be moved into a sort of microbial factories, is the gene for human insulin being moved into bacteria. So now instead of pigs and killing pigs to get insulin, you can you can get human insulin directly from a bacteria that's growing in a tank.

Zakiya: Some people were allergic to insulin from pigs.

Titi: And I would imagine that someone who, for religious reasons or dietary reasons, does not want pork anything to enter their body. This was probably an issue.

Zakiya: And this was a long time ago.

Titi: That they started doing that?

Zakiya: Synthetic human insulin, basically insulin produced by bacteria that was first done in 1978. I wasn't even born.

Titi: OK. So let's get back to heme. This whole process we've gone through is just to get one of the ingredients for the plant based meat. Right. But the majority of the patty is still made up of plant proteins from peas or soy.

Zakiya: They're still using plant based protein. They're still using pea protein and soy. But they have these features that are what we call the specialty proteins like heme, which aren't present in large amounts. This technology allows you to scale up how much heme and how much of the rare you know, the rare jewels is like a power up. It basically allows you to collect way more, you know, I don't know if you used to play Sega Genesis but it lets you collect way more rings. And so now you like I have everything I need to make the ultimate patty. This is a really great way to kind of tackle the supply and demand issue right now that we have with animals, that we have with food in general. There is a demand for food, but the cost to the environment to keep that supply up is really high.

Dr. Agapakis: Often it is significantly lower impact because the efficiency is different. And so like when you're you know, you take sugar and you give it to that yeast, that the conversion efficiency of that yeast into the heme and the volumes that you're talking about are much smaller. And similarly, like the conversion of sunlight to pea protein is a lot more efficient than the conversion of sunlight via grass to cows, to meat protein.

Zakiya: We do have to consider the environment. And there are a couple of ways that this type of technology has an impact. You do have to feed these organisms. So it's not like, oh, this doesn't cost us anything. These organisms don't just like yeast and microbes. Microbes don't just produce stuff without any input. There always has to be some type of input. I think the convenient or a nice thing is that the input is so much lower here. Do we need to build vats? Do we need special lines? And, you know, is there some stuff that's related to the industrial nature of this? Yes. But I think the industrial footprint and there's been a couple of studies that have shown this at the industrial footprint is lower than it is for beef, pork,.

Titi: Chicken,.

Zakiya: Chicken. And I think the other thing that we should consider is the source of these materials a lot easier to harvest than from yeast making heme than it is came from the pigs blood and...

Titi: Animals

Zakiya: Yeah, right. And I think that we have to acknowledge that just like Dr. Agapakis said about the insulin. You know, there's that added benefit. And so by using this recombinant technology to let the microbes create what we need, we then don't have to have such an impact on the environment. Can you imagine growing all that soy, cutting it all down? You know, the only extra only using such a small part of it.

Titi: Yes. And a huge waste. And so the scientists have found a way. They've found a cheatcode a shortcut to getting us the same product, but with less waste.

Zakiya: And I think that is something that should not be overlooked. And I actually think this is something this is where we're going to head in the future, because now what we're talking about is just using this technology to make one small component of a larger product. But some people

are starting to ask, well, if I can use the lab to make this one thing. Can I make animal protein in the lab? Can I make animal tissue? Can I make. Yeah. So now we're going to.

Titi: People are going to feel real funny about that.

Zakiya: They are. But you don't feel funny when they grow the skin and give you a skin graft.

Titi: No you don't. You take that skin graft and you walk out of that hospital head held high.

Zakiya: I know that's not the major way that things are done. Now, most people have skin graft from other areas on their body. But that is a new. That's new technology. Right. And so you really have to ask, where will we draw? Where do you draw the line?

Titi: Yeah, I guess it's just basically up to you. What do you feel comfortable with and what impacts do you want to make on society? And once you weigh those things out, you can make a informed decision,.

Zakiya: I guess. Now, for now, we gotta stick to our crumbles and patties. But I hope to elevate up to.

Titi: You think you're gonna be a vegan?

No. I'm sorry. I even even when I was, I liked the flavor. I don't have to eat the meat, but I need it in there. I need bacon flavor, I need bacon flavor.

Titi: Hey, scientists. Wake up. If you can do that, I'll be right on board. I will put bacon flavor on everything. I'd put it in my toothpaste.

Zakiya: Oh Titi

Titi: If you lick a burger Patty, does that make you. Does that mean you're eating meat? I think you got it like masticate. Like so if I lick a patty, I can be vegetarian.

Zakiya: If you're thinking about it, you're not committed to the vegetarian lifestyle.

Titi: Oh, it's just so hard.

Zakiya: Yeah. We won't. Don't bother joining the group. I don't think you're gonna make it.

Titi: See, now she's trying a challenge.

Zakiya: I know my friend, if its one thing my friend will rise to it as a challenge. She does not like you telling me she can't do something.

Titi: That means I need to head to the grocery store and buy those plant based meat crumbles or whatever they're called.

Zakiya: Oprah said 10 days was enough. Let's do a 10 day vegetarian challenge.

Titi: OK, so we're going to put it up on Instagram's as we do. And whoever is opting in. You got to send us a picture of your food every day.

Zakiya: Yes.

Titi: This is intense.

Zakiya: I'm ready. We are only going to put them on the stories.

Titi: I'm not I'm going to fail the first day because I'm a forget and I'm a be like I had eggs this morning.

Zakiya: That's like I did not tell you? My dad. We were doing that thing. He said, "oh, I messed up. I had brisket for breakfast". Who eats brisket Breakfast?

Titi: That sounds just right.

Zakiya: That sounds just like you.

Titi: Uncle Curtis, that sounds just right.

Titi: That's it for Lab 19. Don't forget to check out our Web site for a cheat sheet on today's episode. You can find it and sign up for our newsletter at DopeLabspodcast.com.

Zakiya: Also, we love hearing from you. What did you think about today's lab? What are your ideas for future labs? Our number is 2 0 2 5 6 7 7 0 2 8.

Titi: You can also find us on Twitter and Instagram at @dopelabspodcast.

Zakiya: Titi is on Twitter @dr_tsho.

Titi: And you can find Zakiya @zsaidso.

Zakiya: Follow us on Spotify or wherever else. You listen to your podcast. Special thanks to our guests, Dr. Christina Agapakis. Find out more about her work in the show notes Dope Labs is produced by Jenny Radelet Mast of wave runner studios. Mixing in sound design by Hannis Brown. Special Thanks to Jen Stanley.

Titi: Original theme music is by Taka Yasuzawa and Alex Sugiura with additional music by Elijah LX harvey.

Zakiya: Dope Labs is a production of Spotify Studios and MegaOhm Media Group and is executive produced by US.

Titi: Titi Shodiya.

Zakiya: And Zakiya Whatley.

Titi: I know what you're thinking. "oh, I don't want all these GMOs" well!

Zakiya: Titi wants to fight you.

Titi: Let me tell you something.