The Tim Ferriss Show Transcripts
Episode 54: Jonathan Eisen, Jessica Richman
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Tim Ferriss: Hello, my clever little monkeys. This is Tim Ferriss and welcome to the Tim Ferriss show, where I dissect world-class performers, interview them (not literally cut them apart and dissect them) to try to extract the tools and tips, and to find the resources that you can apply in your daily lives whether those people be billionaire investors, chess prodigies, famous CEOs, celebrity types, or anybody in between. It's really a wide spectrum of expertise, and you find commonalities.

In this episode we will be talking to two scientists/entrepreneurs specifically about the microbiome. Many of you, literally hundreds of you have asked me to elaborate on the microbiome and what that means, and how I try to manage or improve my own microbiome. We have two people on this particular episode. We have Jessica Richman, who's cofounder and CEO of uBiome, U-B-I-O-M-E.com, startup backed by Y Combinator and Andreesson Horowitz, which uses citizens science to understand the human microbiome. In full disclosure, I am also involved with this company. I helped them long, long ago, and then ended up, only recently, backing the company. We will talk a lot about that.

And then you have Jonathan Eisen, who is a full professor at the University of California Davis with appointments in the School of Medicine and the College of Biological Sciences. Dr. Eisen's research focus on the evolution, ecology, and function of community of microorganisms.

Both of these people are fascinating, very different personality types, and the conversation was a blast. So, without further ado, please meet Jessica and Jonathan.

Jessica and Jonathan, thank you so much for taking the time to be on the show.

Jonathan Eisen: Glad to be here.

Jessica Richman: Thank you. Glad to be here.

Tim Ferriss: This is a distributed pow wow. I'm very excited about this, my first time doing this. Jessica, you are here in San Francisco?

Jessica Richman: Yes. Right in San Francisco.

Tim Ferriss: Right down the street. Jonathan, you are in Vegas.

Jonathan Eisen: I am in Vegas, that's right.

Tim Ferriss: In Vegas to settle some old debts. To settle some old scores? No. What are you doing in Vegas?

Jonathan Eisen: I'm doing a show – no. I'm going out to do fieldwork in Death Valley tomorrow.

Tim Ferriss: All right. This leads us to the very exciting topic, and many topics I'm sure that we'll delve into. I'll start with a very boring question. It is perhaps the most American of all questions. The "what do you do" question. Very specifically – I'll start with Jessica. If somebody asks you these days, I guess your answer might be somewhat straightforward, but what do you do? How do you answer that at a cocktail party, if they still have such things?

Jessica Richman: I don't know if I'm ever invited to a cocktail party, but when I go to conferences people ask me that question. I have to back up a bit and start talking about bacteria. Then either people get this really horrified look on their face or they get this very excited look on their face. Most people are not neutral about bacteria. I say, "I run a company that – where we sequence the microbiome. Those are the trillions of bacteria that live on and in our bodies." Then I pause and wait for the look of horror or excitement to cross over their face to see how much more I should tell them about that. Then it's a matter of time before we get into the subject of poop –

[Crosstalk]

Tim Ferriss: I was gonna – I was just – I knew you were gonna bring it up first. This is a very –

Jessica Richman: Yeah. There's a mean time to poop for conversations.

Tim Ferriss: You're like, "So, how much do you know about poop swabs?" That's the opener. I find that's a pretty good pickup line, also.

Jessica Richman: Yeah. Yeah. It works for me.

Tim Ferriss: Jonathan, what about yourself when someone asks you what you do? What is your answer?

Jonathan Eisen: I'm a professor, and I study and teach about and communicate about microorganisms.

Tim Ferriss: I want to define a couple of terms, partially because, in all honesty, and this is embarrassing, but I've never defined these terms very well for myself. Microbiology – you're currently a full professor at UC Davis, is that right?

Jonathan Eisen: Yeah.

Tim Ferriss: At the UC Davis Genome Center. What is medical microbiology and what is microbiology? What's a good way to think about that?

Jonathan Eisen: Microbiology is the study of organisms that we can't see without the aid of a microscope, some device. They are organisms that are invisible to the naked eye. Then, within that scope of microbiology there's lots of sub-disciplines that people have defined. I kind of hate all of those sub-disciplines, but some people – environmental microbiology is the study of microorganisms out in the environment. Medical microbiology is the study of microorganisms associated with human health. There's veterinary microbiology and plant microbiology and blah-blah-blah-blah-blah.

Tim Ferriss: Do you dislike those classifications because it's kind of like saying breast cancer versus pancreatic cancer versus such-and-such cancer, and you're like, "We should really be defining this by the type of microorganism not the location," so to speak? Or is it something else that bothers you about it?

Jonathan Eisen: In general, I hate rules and I hate stovepiping. I just think it's not that useful to isolate humans from other animals and to say that environmental microbiology is somehow different than the microbiology inside people. It's arbitrary boundaries that have no value.

Tim Ferriss: Okay. I like this. This is a good start. We'll certainly talk about it. You have a very interesting blog. What are – what is phylogenomics or phylogenome-ics? I can never figure out –

Jonathan Eisen: Phylogenome-ics.

Tim Ferriss: Genome-ics, there we go.

Jonathan Eisen: It's both a good and a bad thing. I invented the word when I was a graduate student to basically refer to evolution – phylo is a sort of abbreviation for evolution. And genomics – the evolution of genomes, basically. I regret this because I also write in my blog a lot about the proliferation of bad new genomics words. But nevertheless, I invented the word and then I named everything, all my blogs, all my lab sites, all my login accounts to various sites, they all have something to do with phylogenomics, and I'm kinda stuck with it.

Tim Ferriss: Well, you own it. That's good.

Jonathan Eisen: That is true. I own it and don't like it.

Tim Ferriss: The evolution to the microbiome, and I'm wading very deep into my – into the pool of ignorance on my part when I get into the microbiome, but it became of great personal interest to me because I contracted Lyme disease, went on very long-term, from my perspective, long-term use of broad spectrum antibiotics like doxycycline, and started to suffer from all sorts of health conditions that, from my assessment, were not caused by Lyme disease, but were caused by the long-term use of antibiotics. I started to have skin disruptions and all sorts of issues that are associated with chronic illness. But I had not drawn the connection between some of these supposed chronic illnesses and microbiome.

A friend of mine, who is sort of an amateur microbiologist for lack of a better term, suggested that I start taking L. plantarum and a number of other types of probiotics, and the symptoms – I had this breakout on my feet – pretty much overnight, down by 50 percent in terms of symptoms and then proceeded from there really quickly.

I'd love to know what are the biggest misconceptions, and this is open – maybe, Jonathan, if you want to take a stab at this. What are the biggest misconceptions about the microbiome because it's become a hot topic. Obviously, the fecal matter transplants are very exciting for the media. That would lead me to assume that there's a lot of voodoo and nonsense, also, being spread, therefore. But what are the biggest misconceptions about the microbiome?

Jonathan Eisen: I think that the thing that I – the reason that I am interested in this from a research and a communication point of view is because there's enormous promise from a medical and agricultural and

environmental and evolutionary point of view. Every plant and animal is covered in a cloud of microbes, and they clearly influence the biology of these things that they're living on. There's enormous promise, and there've been a few papers in the last five to ten years that have shown really big impacts of this cloud of microbes on the health of various organisms.

But the part that is also interesting and challenging is, for whatever reason, a lot of people have oversold or over-interpreted the – what we know about the microbiome and aren't doing a good job of distinguishing what we think might be going on from what we know is going on. I give out an overselling-the-microbiome award on my blog, and it's literally the easiest low-hanging fruit blog material that exists in my life. There's so much out there where people make fundamental miscalculations as to how to interpret some scientific study or some personal dietary change or other issues.

Jessica Richman: I think I'd like to add a couple of things to that. I think the first thing is that you noticed anecdotally this change, Tim, right? You take all these antibiotics. You develop this problem. You take probiotics and it goes away. That's not data, that's just an anecdote. But I think –

Tim Ferriss: Yeah, and in fairness, I recognize that it could be correlation not causation. It could be regression to the mean. I understand all that.

Jessica Richman: But still, I don't call it an anecdote to minimize it, but to say that I think one of the interesting things that we're doing at uBiome, and I think is a general trend that is interesting, is this crowdsourcing of science, to enable things like what you experienced to be validated in new ways. I think – I don't think it was my feeling, but it probably was not, just regression to the mean if it happened immediately afterwards. You can sort of see the effects in your own experience. But why did that happen? And does it happen for everyone? How often can that be replicated? All these kind of things are important questions to be answered. Your anecdote is like the beginning of a hypothesis about how probiotics can affect the human body, not just something to be dismissed, I think.

Tim Ferriss: Absolutely. I'd love to hear you elaborate a little bit on what you – how you would define or think of 'citizen science' because I think we're leading into that pretty quickly.

Jessica Richman: Citizen science is a term that was coined by the Cornell Ornithology Lab in the, I think, in the '70s. It was basically the idea that citizens, people that are not Ph.D. scientists working in a research lab can create interesting science by collaborating with scientists. In the case of ornithology, it's really interesting that there aren't enough bird watchers in the world – there aren't enough ornithologists in the world to watch all the birds, so they use amateur birdwatchers to contribute date very frequently.

That's sort of grown into this idea that other types of scientists can include the public in their research, whether it's data collection or, even going further, it's generating hypotheses, funding science like we did at uBiome, open sourcing, publication of blogs about their own experience, their own experiments. All these things are sort of citizen scientists, crowd scientists, people who are not employed in the job of science, contributing to science and adding a new perspective that isn't there in mainstream science.

Tim Ferriss: Got it. I wanna come back to – Jonathan, I'm gonna ask Jessica a few more questions, and then I wanna come back to you and ask you. You have so much experience with research, I'd love to ask you about what is wrong with the current ways in which research is done or has to be done, and how you, in a dream world, would fix that because I think it's an interesting topic.

Jessica, I'd love to ask you, just on the – to give people a taste, and again, understanding that "the plural of anecdote is not data," although I do have some issues with the over-use of that expression.

Jessica Richman: I do, too. I do, too.

Tim Ferriss: I'd love for you to comment because we've talked about some of these things before, obviously. I'm involved with a backer of uBiome and believe in the mission. I was a supporter long before I was ever involved in a formal capacity. Could you talk about gut, mood, and behavior, maybe highlighting some of the things that you've found most interesting in the last few years?

Jessica Richman: There's a lot of – let me just back up for a second. The obvious things that you think of when you think of the gut microbiome are health conditions that involve the gut. You think about traveler's diarrhea. You think about enteric dysfunction. You think about irritable bowel or Crohn's disease or all those sort of obvious things that involve your gut. But what you don't often think about are other health conditions that are much more systemic that relate

to the microbiome. There's been some interesting research about, mostly, mice; about how you can change a mouse mood by changing the mouse microbiome.

I know this sounds a little nuts, but there are measures for whether a mouse is anxious or depressed or has autism, actually. It's an interesting study I was just reading earlier today. By giving – by taking germ-free mice or mice, these are mice without any microbiome, and then by adding either an anxious microbiome from an anxious mouse or from a not-anxious mouse, you can change the mood of a mouse. This has been done in a number of different ways with other mood disorders in mice, and there has been human research specifically. They notice different microbiomes in different – in humans have different mood conditions, but there's no causal research there.

That's a really interesting area. I think it's interesting mostly because it points to how complex the microbiome is and how complex its effects are. It's not just the obvious. You have diarrhea, that's because you have a microbiome problem. It's much more dispersed throughout the body and the effects the microbiome has can be much more subtle.

Tim Ferriss: This is – this comes back to something that Jonathan said about distinguishing between what we truly know and what we think we know. There's often a very large discrepancy between the two. For a long time it was thought that fat cells were basically these inert storage devices without much function beyond that, but a lot of endocrinologists have begun thinking of adipose tissue almost as – well, it is, basically, hormone-producing endocrine glands, in a way. It's very active. There's brown fat and different types of adipose tissues.

One of the things I've heard from some scientists I've chatted with about the microbiome is that the gut can be thought of as the second brain. Where I've lost track of the argument is how the gut, if it does in fact produce neurotransmitters like serotonin, or is it just that the composition of the microbiome in the gut then affects brain function in such a way that it affects neurotransmitter production?

[Crosstalk]

Jonathan Eisen: I think it's all of those, right?

Jessica Richman: Yeah. There are a few hypothesized mechanisms, and, Jonathan, maybe you can expand on this more than I can. To start off with, there's this idea that inflammation, that microbes cause inflammation in the gut, and then your brain misunderstands – feels that you're kind of out of sorts and inflamed and then thinks – is anxious about that. You assign that to your work situation or your romantic situation when really you're just irritated because your gut is irritated. That's one hypothesis.

Tim Ferriss: Right.

Jessica Richman: Another one is that the microbes are actually making chemicals that induce behavior in you. They're making you crave sugar because they want sugar, not because you need sugar. Maybe even making you crave things that you can't digest but that they can.

Tim Ferriss: Interesting.

Jessica Richman: Which is a matter of survival for the gut microbes. The only way they're gonna get fed is if you eat what they want you to eat. That's another idea.

Tim Ferriss: They're pulling a feed me, Seymour, sort of –

[Crosstalk]

Jessica Richman: Exactly.

Jonathan Eisen: I wonder if we can take a step back for a second. I've been and many other people have been working on how host animals and plants depend upon single bacteria, single mutualistic beneficial symbionts in a variety of ways. We know from diverse studies of plants and animals that lots of insects need bacteria that live in their gut to make amino acids and vitamins they don't get in their diet. Lots of plants get nitrogen via bacteria that live inside their roots. Organisms that digest cellulose, like termites, have microbes that are doing it. There's just hundreds, thousands, of examples where a microbe is providing some critical function that the host is not doing for itself.

There's also, of course, we know lots about the hundreds to thousands of examples of pathogenic, dangerous organisms that cause some disease or some problem where they manipulate the host biology in all sorts of bizarre, interesting, and damaging ways. In that context, it's almost obvious that the microbes that live in our gut and in our mouth and on our skin and in our other orifices

and places have the potential to do all sorts of things to our biology.

Again, if you – the way I think about it, I'm actually an evolutionary biologist, the way I think about it is animals have been evolving in this microbial world for hundreds of millions of years. Our evolutionary processes are, in essence, based upon expectations. The expectation for our gut and our immune system and our behavior and everything is that we're gonna encounter microbes because we always do. Our systems are tuned towards predicting and responding and dealing with microbes. In that context, it's almost obvious that microbes that are in and on us are fundamental parts of our lives.

Tim Ferriss: To give – I'd love to do a quick fact check. I've heard that – I've heard people say that humans are really 10 percent human, meaning that by volume or number of cells, 90 percent of us is comprised of bacteria. Is that –

Jonathan Eisen: There was a really good fact checking that someone finally did in, I think, in the *Boston Globe*, where it turns out that number which had been quoted for 20 years or so is almost completely made up. Better estimates are probably something on the order of 50 percent microbe.

I don't think it – I don't think that the total number of cells is that interesting. What I think is more interesting is that in our mouth there are probably, in each individual person, there are probably something on the order of five hundred species or a thousand different species of microbes. In our gut, there are a thousand in each different compartment and they're not always the same. The things in the stomach are different than the things in the ilium or different than the things in the colon. On our skin and in different parts of our skin – we are an ecosystem with an incredible diversity of types of organisms and functions. Each person, it's gonna vary how many they have, how many cells there are. It's gonna vary over time. But we should view ourselves as a walking ecosystem, not as an individual human.

Tim Ferriss: If people wanted to learn more about the – actually, let me take a step back. I promised I would ask a question so I will ask that. That is, for researching the microbiome or anything else, how is it currently done? How would you change it? What are the issues with accelerating good research in this field or any other, for that matter?

Jonathan Eisen: I think the reason everybody is excited now, the reason that Jessica was able to start her company, and the reason that there's a lot of stuff going on is that the technology for studying microbial communities has gotten much better and much cheaper in the last few years. Primarily, the way people do this is using analysis of the DNA from a sample.

The reason we do that is most of the microbes in any particular environment can't be grown in the lab. We can't identify them very well in a microscope. We can crack them open and we can look inside of them. We can look in particular at their genetic material, their DNA. That DNA contains a lot of information about the microbes that are there. That helps you identify what kinds there are and it helps you predict what their functional potential is.

In that context, I'm like a kid in a candy shop. It is the golden age of microbial ecology right now. I wouldn't say there's a ton, per se, I want to change. What I really want to do more than anything else is engage the broader community in thinking about microbes just like Jessica's trying to do. We're limited by the number of samples we can get.

Tim Ferriss: Right.

Jessica Richman: Yeah.

Jonathan Eisen: What we want is a hundred million samples, to be honest. I can't do that myself. I need a million people to help me collect samples. That's what I wanna get people to think about.

Jessica Richman: I agree with that. I would say – I have a lot of thoughts on this because it's something we think about a lot, how to make research accessible to the public. How to make it larger, more scalable, more actionable in people's lives. I think larger studies is a huge one. I think that you can have a very respectable study in a major peer-reviewed scientific journal, *Nature*, *Science*, *Cell*, something like that, and you can have 100 people in it. I think that that's going to seem ridiculous ten years from now, 15 years from now, when it's obvious that you can source study participants more easily and that you can involve the public in your study and have things move much more quickly.

I'd love to see that happen. I'd love to see studies be more scalable and flexible, so that you can start off with a certain study

design asking a certain question. Then because you have your 10,000 participants or your 100,000 participants, you can take a subset, say that's the interesting part and go forward with that group. You can make the whole apparatus of creating scientific studies better, larger, and more scalable.

Jonathan Eisen: I was just gonna say I think that the one thing that maybe I would say we need to do in the future that we're not doing as much of now is that a lot of the work that we're doing is incredibly exciting and really interesting, where we can use DNA as a fingerprint of what's going on in the community. But this is building, in essence, some type of general profile of the world around us. We can compare and contrast health and see states. We can compare people over time. We can compare people before and after, like you, antibiotic treatment. We can do lots to get a general idea as to what's going on.

But, of course, that's just the first step. There's lots more really interesting biological studies that can be done once you have this framework that comes from characterizing the DNA of the communities. We can start to look at the functions actually encoded in these genes. We can do experiments to test those functions. We can look at where individual cells are located in particular environments. A fecal sample doesn't tell us anywhere near as much as a full microscopy staining of the entire gut. Things are floating around in the liquid. Some are on the layers of cells. Some are inside cells. This is the first step in characterizing this system.

Jessica Richman: Yeah.

Tim Ferriss: I'm sorry. I was just gonna ask quickly – well, just a couple of observations for people who listening who are from a lay audience, like I am. I'm not a trained scientist. I read just enough to be dangerous. I've spent some time at UCSF with a couple of the neuroscience labs. I think that – I wanna come back just briefly to "the plural of anecdote isn't data." This is a term that is used a lot by people who don't really understand the design of scientific studies. It's worth pointing out a few things, and please, jump in and correct me or edit anything that I say.

If you look at, for instance, the development of the smallpox vaccine, which was introduced by Edward Jenner in 1798, he observed, and one could say this is anecdotal, that milkmaids who had previously caught cowpox did not later catch smallpox. The way he demonstrated this could be causal is he, as I understand it,

took cow pus and injected it into his family. Needless to say, pretty ballsy. The point being that the observation helped him form the hypothesis and that could be derided by this, "the plural of anecdote is not data."

When there's a study, you brought up 100 subjects. Oftentimes, people from a lay audience will say, "There are only ten subjects. That's a bullshit study." There are a couple things you have to look at. You can look at the number of, the N, you can look at the number of subjects, but you also have to look at the amplitude of the change from the intervention if you're doing a control and experimental group. If you have ten people but they all double their working memory, okay, there might be something interesting there in terms of the P value, right? And the likelihood that that's attributable to chance is rather low.

Jessica Richman: I'd say, Tim, I think that's true. I would say, "The plural of anecdote is hypothesis more than it is data." That's the example that you're giving.

Jonathan Eisen: My personal view on this is that many scientists, many of the supposed cognoscenti just are assholes. Let's just be clear. They say things like that because they want to put themselves up on a pedestal. I think that if you go back to your question about the future of experiments and science in general, I think what we need in the future is for much more of these observations, all the way through to clinical trials, to be published, and to synthesize the collection of knowledge from across the planet more than we need suppression of work that people do simply because one person thinks it doesn't have enough statistical sample size or something like that.

That is the ultimate – and in fact, I spend half of my time working on scholarly communication and open science, not on microbiology. I think that this is the biggest issue that we have right now, trying to broaden scientific research and not to suppress it. It drives me crazy. It makes me just go insane when I hear anyone say anything like that quote. I hear this all the time in graduate student committee meetings where one person will say, "That's not hypothesis-driven research, that's discovery science." God! Just get out of science, for god's sake!

Tim Ferriss: This brings up a follow up question I'd love to ask you, which is if you had, let's just say, five million dollars to use as you see fit in

science, whether it's for the microbiome-specific stuff or the open science initiatives or both, how would you spend that if you had carte blanche? Here's five million, assuming it's not to run off to Monaco and buy Lamborghinis. You can use this for almost anything you want. How would you spend that?

Jonathan Eisen: I would invest it in lots of small projects. I think that –

Tim Ferriss: What types of small projects?

Jonathan Eisen: What I see is that creativity by researchers, by citizens, by graduate students, by undergrads, by high school students, that the creativity that people have about science, about microbiology once they learn about microbiology, is enormous. What we need to support is ways that those people can leverage their creativity to do a research project. What I would not do with the money is give one person the five million dollars to do a big project. I don't think that that's – we have a lot of those projects, anyway. What I really think we need is to harness the anecdotes, the observations that people have made. They may not all turn out to be useful interpretations, but there's a lot of stuff out there that needs to be studied. We need more people doing it.

Jessica Richman: I think – that's interesting. If I had five million dollars that someone handed me to do this kind of research, I think you're right. I would break it down into small chunks. I think that makes a lot of sense. You let a thousand flowers bloom so you see what comes up.

But I think in terms of the microbiome what's most interesting is to accelerate the process of taking these correlational studies that we have now, which say, "Oh, isn't this interesting. People with X health condition, whether that's anything from Crohn's disease to autism, people with that health condition are different than people that don't have that health condition." I think that's the state of a lot of the research. I would use that money to do a number of studies that would move the research to the next phase, which is, "Great. Where's our diagnostic and where's our therapeutic based on that?"

I think the real power of the microbiome and what's magical about it is that these microorganisms are both bio-sensors that can tell us what's going on in the microbiome. At the same time, they're also drugs. They're organisms that, when you put them in the ecosystem of our body, change the outcome from a clinical perspective. Moving things from this associational stage to a

specific, I don't know, you could call it a product stage, but to a specific improvement outcome. I think that's going to happen anyways because a lot of people do have 5 million dollars and they're spending it on that, which is a good thing. I would also take my five million dollars, and knowing what I know now from working on uBiome, I would put that to good use in those areas.

Tim Ferriss: I think the micro-experiments are really undervalued because, for whatever reason, it seems like the – a lot of the scientific community undervalue the things that cost very little money because of advances in technology. For instance, and this might seem like a silly example, but the late Seth Roberts, very smart guy, very good at crunching numbers and spotting methodological flaws, introduced me to this very simple – and there was a fair amount – he did a fair amount of literature review to try to figure it out, the combination of vinegar plus honey in hot water before going to bed. I was able, in the span of about 48 hours, to have several thousand readers test this, people who had insomnia to test it and compare it, obviously, subjectively to qualitatively with other things they had tried, like Lunesta or whatever.

It was astonishing how positively people responded, but I struggle with how to gather that and codify it and present it in a way that can be graphed intelligently.

Jessica Richman: That's absolutely it. Right. That's a valuable study. If you put a hypothesis in the beginning and a publication at the end, there's some – that's a scientific study. You just have to structure it properly.

Tim Ferriss: Exactly. What's exciting to me, at least, is I have a captive audience of a million plus people per month. You can make up – you can compensate for a lot of flaws in the data with large numbers, right, with the law of large numbers. If you have enough people, you can smooth out a lot of the rough edges.

Let me dig into a slightly different question, and Jessica, I'll toss this to you first. A lot of people think about probiotics. There's obviously a huge industry around probiotics. Some of it, even from my untrained standpoint, look pretty nonsensical, or they're pushing the claims really far. Or they're using, for those people out there who don't know the term, "puffery." I don't know if you guys have ever heard this expression. There's a legal definition. Puffery is when you make claims that are nonsensical, they're non-falsifiable. If you buy a shampoo that says, "Betahydroxylizing hair-volumizing formula," that's puffery because it's all fucking

bullshit. That kind of stuff is used all the time in supplements. "Increase your vitality and blah, blah, blah." Vitality? Puffery. Bullshit.

What I wanted to chat about because I had this planted in my head by a friend who's – he's an amateur scientist, but in the same way that – I'm not gonna say Darwin, but people who ended up coming up with pretty fascinating things were amateurs. He talked about the importance of, more so than probiotics, treating your gut microbiome like a rain forest where you need to create an environment in which plants can grow. You can't just stick plants into the sand and hope that they'll take root. He has focused quite a lot on foods that have, whether it's, say, beans, lentils, things with fiber or prebiotics like baobab root and so on, to help the body create an environment in which beneficial bacteria can thrive, as opposed to swallowing a lot of pills with said bacteria within them.

Again, all of this might be BS. I don't know, but how do you guys think about this? Jessica, I'll let you go first.

Jessica Richman: Let me start with that one. This is a great topic. I'm really glad you brought this up because there's – I have a lot of thoughts about this. The first thought is that people have to use that language of puffery because – for legal reasons. They can't say "This product is going to make you healthy in these specific ways." They have to say, "Increase vitality," which is total nonsense.

Tim Ferriss: They can, but it's expensive to get FDA clearance.

Jessica Richman: That's clear enough. It is expensive. I think people also use that puffery because – I hate to say it, but the current state of the probiotics industry is that if you have a study that shows that your probiotic exists in the bottle and is taken by the people that take it, and shows up somewhere in their stool after they've taken it, that is a gold standard, amazing study.

Tim Ferriss: Wait. That's like if it's excreted, meaning the Olympic athletes having the most expensive urine in the world kind of thing.

Jessica Richman: Exactly. It's really – I think this is – I mean no fault to the probiotics industry here. This kind of testing, to better understand the microbiome, is only possible in the last few years, so this is why they haven't done this yet. This is a over-thirty-billion-dollar-a-year industry. It's a huge industry. Basically, the science supporting it hasn't been there.

I was at this conference that was a nutrition business journal conference. There were all these executives there from the nutritional supplements industry. They're just starting to start to figure out how are we going to, in an age where everyone can test things about themselves, the age of the quantified cell, and in an age where DNA testing and bacteria can – it's pretty much [inaudible] and we charge $89 each. That's really cheap. Everyone can test themselves. How do we make sure – how do they make sure that their products are actually doing something and are actually valuable?

I think there's going to be this – I think the probiotics that you see on the shelves today in Whole Foods are going to be totally different ten years from now because the public will demand better. They'll say, "Wait. I took this. What's it doing for me?" And because the science – it'll be possible to do better. I think they'll be way – the probiotics industry is poised for this tremendous leap into better products that actually do a lot more for you. And that can be tested apples to apples with prebiotics, like you said.

Are prebiotics better? It probably depends on who you are, personally. It depends on your health conditions. It depends on are the probiotics that are written on the outside of the bottle actually in that bottle?

Tim Ferriss: Yeah, there's that, too.

Jessica Richman: It sound silly, but that is actually a huge factor. If they're not – there's currently no sort of testing for what's live. I think there's gonna be a big change in that industry as these new technologies work their way through and let people develop better products going forward.

Tim Ferriss: Did you buy an expensive bottle of dead sea monkeys?

Jessica Richman: No.

Tim Ferriss: Yes. I'm sorry. Jonathan, go ahead.

Jonathan Eisen: I was just gonna say that the growing appreciation of this cloud of microbes, the microbiome, that it's an ecosystem, or at least it's complex like an ecosystem, is – there are ways that we should be thinking about this ecosystem that probably the simple model of probiotics didn't take this into account. We need to think about the dynamics of competition going on in the ecosystem, of the

different members competing with each other for food and for space. They're gonna grow and reproduce at different rates within the system. But just like any other ecosystem, there's going to be influx, that is new organisms coming into the ecosystem. There's going to efflux.

There's two hundred years of ecological research on studying these things. Probiotics are – have the potential to impact the system because if you have a massive influx of some individual species into an ecosystem, it can impact it either on the short term or the long term. But it's a very simple component of the total picture of the ecosystem. A good example of this is if you take a savannah, or a chunk of savannah, and you isolate it, and you introduce into that savanna a thousand cattle, they're gonna disappear pretty darn fast. But if you introduce a thousand zebras, organisms that are roughly the same type of organism but they're adapted to living in that ecosystem, they're gonna do differently. If you introduce 50 species at a time that represents something akin to what is naturally there in the ecosystem, that's going to be different than introducing a billion of one kind of organism.

The more we think like ecologists, the more we think about the dynamics of the ecosystem that is the gut or the mouth or the vagina or the skin or wherever there are lots of microbes, the more we're gonna be able to make sense out of the puffery that is associated with the promotion of certain treatments, and the more we're gonna move into a system where it is useful.

Tim Ferriss: No, definitely. The conversation brings to mind a past conversation I had with a really, really fascinating guy named Steve Rinella, who is a hunter. He's the one who introduced me – I'm not, have never been a hunter, but was introduced to it for researching my last book when I wanted to hunt and forage for all my food for a period of time.

He was talking about the politicized response to reintroduction of, say, wolves, and how, when you try to oversimplify it, just like carpet bombing your system with 20,000 pills of fill-in-the-blank single type of probiotic or bacterium, you could introduce, say – wolves are dying at an alarming rate. They are nearly extinct in this one place. Let's add 1,000 wolves. That doesn't really work very well because it throws the entire system out of whack. Then you start – then you have a mass genocide of their primary prey.

What he pointed out also, and I think this is kind of interesting, is that the microbiome people associate, I think, broadly with the gut.

They think microbiome, they think, I swallow pills, put them in my gut. They're reading about fecal transplants and whatnot. It's a lot, and as you mentioned, Jonathan, even in the GI tract, you have these vastly different populations in different areas. What Steve pointed out, he said people are against hunting wolves, for instance, because they're thought of as very sparse. But the fact of the matter is, they're very, very, very overpopulated in very specific areas. Therefore, the averages are misleading. You should hunt and cull in certain places. But I'm getting a little down the rabbit hole with this story.

I'd be very interested to hear, Jonathan, you comment on the, from the evolutionary standpoint, how do people go about figuring out what to aim for when it comes to that ecology? In a natural environment, you can say, "Everything's going to hell in a hand basket. Something is wrong." It's perhaps more obvious to pinpoint problems. Should we be looking to tribes in Tanzania or Papua New Guinea or the untouched parts of the Amazon, if anything exists like that, to try to – where the children haven't had antibiotics? How do you determine the menagerie of bacteria and the balance to target or to aim for?

Jonathan Eisen: It's actually a very complicated question, a complicated research topic. Certainly, understanding where our microbiomes used to be in the past is a very helpful component of answering your question. If we can get access to mummies and bog people and the Ice Man and other ancient samples, microbial studies of those samples are being done, and they're very important for placing what we see now in a evolutionary context. Other people are going out and looking at populations of humans – even just diverse sampling of the human population, but looking at populations that have been less exposed to certain types of food or certain types of drugs or certain types of environments. That is also providing that context.

We – in my research, in my lab, we work on the methods by which you would compare to evolutionary relatives or to ancient samples to try and figure out what the microbic community used to be like. The reason you want to know that is two-fold. You want to know what the immune system and what the organs and what the blood and what the rest of the body evolved to see, and you also want to know how it's changed. With humans, obviously, we want to know how it's changed in response to antibiotics and in response to changes in diet and in response to globalization and other issues.

Now, that still doesn't tell us what the goal should be. We live in a world now that's different than the world we lived in 20,000 years

ago or 20 million years ago. But it gives us that framework to help interpret when you then do a study, say, of comparing people in Japan who live in Japan now to people from Japan who moved to the United States. There have been a few microbiome studies like that. It helps you figure out what the disturbance is and what that might mean for our biology. But I don't think it's obvious how to say we should have a goal of making our microbiome like it used to be 20,000 years ago. We have different diets. We live different life spans. We have different interactions with other communities. It's pretty hard.

Tim Ferriss: Yeah. It seems extremely hard. Jessica, what is – what are some common disrupters of the microbiome? It's certainly difficult to decide what the ideal should be, but what are we aware of that can disrupt or cause problems with the microbiome? I've read certain, I wouldn't call them studies at this point, but that things like Splenda, artificial sweeteners can cause issues with the microbiome. What are other common disrupters of the microbiome?

Jessica Richman: That's such a good question. I want to stress with that point about there is no ideal microbiome. I think that's important, there aren't. People often ask, also, about are there good bacteria or bad bacteria. From an ecological perspective, you can't say – a good bacteria in the wrong place is a bad bacteria or a good bacteria at the wrong time. I think some of that exoticism about let's go back to our ancestors is not a way to find the right – to learn how to cultivate your microbiome, I guess.

In terms of disrupters, let's start off with the number one elephant-in-the-room disrupter which are antibiotics. We see this in the results of people taking our tests. When you take antibiotics, a day later your microbiome – there are whole genuses of the microbiome that are just not there anymore. Presumably, they come back as you test yours microbiome – as your microbiome recovers from the shock of the antibiotics, but it's definitely very clear that taking antibiotics kills whole swathes of the microbiome.

The study you're referring to about the artificial sweeteners was showing that it can be – that artificial sweeteners can affect the microbiome in the way that sugar can. I don't know if it's so much of a disrupter, but I think the big thing is changes to the microbiome in terms of diet. There's some really interesting research about people – what happens when people have celiac or people who are gluten intolerant eat gluten and how that affects their microbiome, and how it increases inflammation tremendously

even after they've stopped eating gluten. Presumably there are mechanism of microbes that are still there from when they ate gluten and they're still causing inflammation.

There's some interesting research about dairy that shows some similar things. It's all the usual suspects in terms of what we think of as disturbing our gut is also shown to have impact – it's immediate, some of that impact, through the microbiome.

Jonathan Eisen: Can I add there's another component that I view of as a really big "disturbance," and it's more of a disturbance relative to what our bodies evolved to expect. That's early in development, caesarian sections, for example –

Tim Ferriss: Right.

Jessica Richman: That's a good one.

Jonathan Eisen: – or feeding formula instead of breast milk, or excessive cleanliness as a child, there's a lot of epidemiological data and some microbiome data that shows that all of those things that, in essence, change the colonization pathways for how a young human being will get colonized can lead to longer-term problems. I view that as a disturbance in the microbiome because vaginal birth can be viewed as a delivery mechanism for microbes. As a component of it. Obviously, it's not the only thing. Breastfeeding is clearly intimately tied with development of the microbial community.

Even playing in dirt and experiencing the microbial world in some normal setting – that's what we evolved in that type of environment. Whenever we disturb that, whenever we deliver by C-section or have antibiotics or don't breast feed or are excessively clean or have all of these things that are not the normal developmental path – it's not that those are always bad. But they change the way our system sees microbes. Some of the time, our system's response to that is inflammation or problems with the immune system development or other types of developmental abnormalities. I think that –

Jessica Richman: There's a – I'm sorry. Go on, Jonathan.

Jonathan Eisen: I was just gonna say I think that those should all be viewed as disturbances, too.

Tim Ferriss: Definitely.

Jessica Richman: There's some interesting research about autoimmune disorders. The hypothesis is that autoimmune disorders develop because the body doesn't have the – the hygiene hypothesis on steroids – is that even autoimmune disorders are not caused by current lack of microbes, could be caused by lack of microbes at a specific point in human development. You take antibiotics in your first year. It triggers something in certain individuals who have a genetic predisposition to develop Crohn's disease, for example. That part isn't proven, but I think it's very interesting because you want to look at microbial development on a timeline, not just what happens to be present in your gut right now, but what was present when certain events occurred.

Tim Ferriss: That's a really fascinating way to look at it. Jessica, you introduced me to a gastroenterologist that maybe we can name another time, but since I'll be talking about our conversation, I won't name her right now, very, very bright. She asked me quite a few questions. One of them was about my antibiotic use when I was a child as opposed to adult, and how that could contribute or not to immune function now, even though, perhaps, I had, as I did, for instance, chronic sinus infections when I was a kid. It's really fascinating looking at the chronology of your microbiome to follow the gingerbread trail to your current state, not just looking at the snapshot of the current fingerprint of your microbiome is interesting.

Jessica Richman: What I'd love to do is, I think – and maybe it's natural that I would think this, but I think that it would make a ton of sense to take a fecal bank when – at various times in a person's life so that when, later, we have the technology to create artificially that community of microbes, you can give it back to you.

Tim Ferriss: Whoa. That's a good idea.

Jessica Richman: Wouldn't that be awesome? You take your gut right now when it's relatively good, if it is, or your gut throughout certain points in childhood. You bank that sample, and then when we know how to recreate microbial communities better than we do, you just say, "I want the gut of a 20 – I want the gut of myself at 25," or "I want the gut before I had an onset of Crohn's disease." Okay, great. We'll give you – we'll tell you exactly what was in it, and we'll give it back to you.

Tim Ferriss: Here's a question. Jonathan, is that technologically feasible? If you had access to the nitrogen and apparatus to freeze it like a

sperm sample or a stem cells or whatever, could you bank fecal matter or would it obliterate the –

Jonathan Eisen: No, no, no. First of all, people are doing exactly that. They are, for their children, freezing fecal samples with the hope that either they will be characterized in some way, like with DNA analysis, in the future, or that you could recover the living organisms from those samples. You can, certainly, recover living organisms from samples if they're frozen in the correct way. There's this stool bank fecal transplant organization that was started by people from MIT that is doing exactly that: trying to store fecal samples for fecal transplants.

For future, there's definitely the technology to do this, at least at some level. I don't think we know how to identify which of the samples are the ideal sample, and not everything survives that freezing. You can't necessarily recover the entire microbial community. There are – I know multiple researchers who are doing exactly this, collecting samples weekly, monthly, or something to that effect; storing them; characterizing them in some detail; and then anticipating, as part of a research study, restoring some from the past if something goes wrong.

Jessica Richman: We do – this is something we offer to people. If you sample your microbiome now, even if there's nothing particularly interesting you find in your sample (although that's unlikely, it's possible), then you can – you'll still have it. We'll know what was in it. I think where the technology isn't there yet is in, like Jonathan said, in bringing the microbes back to life. The Lazarus microbe is not – doesn't exist yet. Certainly, the characterization is there. Certainly, you can say here's what it was like. When the technology gets to the point where you can actually then recreate that community or infuse that community in the proper way, you'll at least know what was going on at that time.

Tim Ferriss: It seems like, as Jonathan mentioned, the – as we are able to identify and classify more microbes, and of course we're limited in terms of the big picture, the complete picture, by what we're able to identify, but, and Jonathan, maybe you could talk to this, but it doesn't seem like from a usage of recombinant DNA and replication of these bacterial strains like you could figure out the percentages and have the synthetic poop made to order kind of thing –

Jessica Richman: Yep.

Tim Ferriss: – to implant at a later date in time. I don't know. That's pretty exciting. I know – I interviewed a woman named Ph.D. Rhonda Patrick on the podcast not too long ago. We were talking about banking stem cells and how parents can keep the child teeth, the teeth that are lost by their children, for stem cell banking. It seems to make a lot of sense. I can imagine after this podcast there's gonna be some intelligent and proactive tech millionaire who decides to have a poop cellar right next to his wine cellar with a gazillion samples. Unlike freezing eggs, humans, at least most of them, seem to poop quite a lot so there's no shortage of material.

Jessica Richman: I just wanna say, that's something we promote to people, that you can have that sample. The core thing that's interesting, also, about banking poop is that, let's say, the analysis methods of today are not the right analysis methods. We do 16s sequencing. You can also do full metagenomic sequencing which is finding everything that's in the sample. Let's say none of those work and we actually need some totally other method. If you at least have the sample, you can go back using the method of five years from now which is way better, and use that to do whatever kind of analysis that you need.

Tim Ferriss: Definitely. I've been – since it's just us, just us on the phone here –

Jessica Richman: And the million other people, literally.

Tim Ferriss: – and the million other people. Hi! I have been banking sperm on and off for the last five or six years. One could argue, "You're 36, 37. It's already too late, pal. Your sperm is definitely past its prime." Be that as it may, which I suspect it is, we do not know what technologies or techniques may become available in the future for rejuvenating or modifying those samples, also, right?

Jessica Richman: Right.

Tim Ferriss: So, from my perspective, it's like, "Look. If you're spending hundreds of dollars a year on car insurance that you never use because you don't get in an accident, what's the harm in spending an equivalent amount on storing biological material that could prove, even in a 10 percent chance, to be very, very helpful and could even save your life at some point, or something like that."

Jessica Richman: That's a really good example on an individual example level, and also on a scientific level. I was talking to someone at – in the UK about NIH – not NIH but NHS banked samples, and how, because

it's a national health service, they bank all their hospital samples. They bank – they have fecal samples and blood samples going back to World War II. How interesting is that! From a personal perspective, yes, of course you want to bank your own sample. But also, think about being able to license the use of those samples, or just give that data to a researcher that's studying something really important that your family could benefit from, or a future sufferer or – the possibilities are endless there, to be able to take that date and make it valuable once you have it.

Tim Ferriss: Let me ask a curve ball question. It's not too crazy. It's just unrelated to what we were just talking about. The question is going to be what do your close friends think you are world-class at? Jonathan, I'd love to have you take a stab at that, if you wouldn't mind.

Jonathan Eisen: Social media. As far as I know, that's all they know about what I do.

Tim Ferriss: And branding. Phylogenomics.

Jonathan Eisen: Yeah, exactly.

Jessica Richman: Making up words? That isn't –

[Crosstalk]

Jonathan Eisen: And studying weird microbes.

Tim Ferriss: Within the world of studying weird microbes, what are you known for, would you say? In response to what would someone say, "Ah! Jonathan's the guy you need to call to talk about that."

Jonathan Eisen: I think it's using an evolutionary perspective in trying to study or design ways to study individual microbes or communities of microbes. A lot of people, a lot of researchers do great work on characterizing a particular microbe or a particular system, but they're focused on just that system with a lot of their work. What I really am known for, I think, and what I specialize in is saying, "That's really interesting. But on top of that, it can be really helpful to understand the history behind that organism. That can tell you what direction it's going, where it came from, and allow you to make predictions about where things are going in the future."

I think my whole career has been taking that one theme, adding an evolutionary perspective, and applying it in a lot of different areas. Hopping between genomics, that's phylogenomics, and microbial communities, and functions of microbes, and how organisms survive in extreme environments, and what lives in non-humans or on other organisms, and always saying, "Oh, yeah? But what about the history?"

Tim Ferriss: Right. What – I really want to ask you a question, but before I do because I suspect it might fit in this category, what are the most – what are the questions that you get asked from a evolutionary standpoint or evolutionary biological standpoint that are most irritating to you?

Jonathan Eisen: What is the most ancient microbe alive? All microbes are all equally ancient right now. None of them are old. They all grow and replicate. That always drives us – that always drives us crazy. Another is why – the classical intelligent design questions. I guess I don't find those irritating. I get a lot of them, but I don't find them that irritating because they're so common. Another thing that I would say completely drives me crazy, and I get this question a lot, is why study that in microbes? Microbes are so simple.

Tim Ferriss: That's a rather condescending way to put it.

Jonathan Eisen: I know. It has so many layers of inappropriateness and condescension. I don't even know how to respond sometimes.

Tim Ferriss: You just side kick them. That's usually – I find that pretty appropriate. The question I was gonna ask you is how did Adam and Eve ride to their wedding on a dinosaur? That's really what – no, that's not my question. I'm kidding.

Jonathan Eisen: The microbes made them do it.

Tim Ferriss: The microbes made them do it. That's driving behavior. Those dinosaurs had a lot of sugar. The question I wanted to ask you which is off-base but I get asked this so often. I would love to have a more informed answer to it. And if this is outside of your area of expertise, please feel free to dodge. What have – how should one answer the question – let me rephrase it. What do you think of the paleo diet or vegetarianism? I'll just throw those two out there.

Jonathan Eisen: Vegetarianism – and any – I hate all rules, first of all, in all sorts of different environments. Any time someone says, "I'm gonna apply

some rule to my life or to science or to something else," I get irritated by it. The paleo diet, I think, is a great example of something that is interesting from a conversational point of view, to think about how people used to live and what they used to eat. But to apply it to our modern lifestyle as though it's going to somehow be magically perfect seems a stretch to me, let's put it that way.

Tim Ferriss: Are you trying to tell me that cavemen did not eat coconut macaroons? I'll be very disappointed. No, I'm kidding.

Jonathan Eisen: I think cavemen did a lot more than we appreciate, as they just discovered those supposed etchings on a shell from 500,000 years ago. We're always finding new, interesting behavioral patterns in Neanderthals and in cave people. I think we under-appreciate what the ancient human lineages did. I certainly don't think imitating everything they did is the right way to go.

Tim Ferriss: Yeah. I don't have a particular dog in this fight. What about vegetarianism?

Jonathan Eisen: From a health benefit point of view, I think it's not necessarily – it's also – it could be good for some people, but not necessarily good for every person. That's a separate issue from the political point of view.

Tim Ferriss: Of course.

Jonathan Eisen: Very clearly, the current mode of production of meat on this planet has enormous ecological and health problems associated with it. That doesn't mean going out and raising your own cattle and hunting and other things wouldn't be relatively not as damaging to the planet. But production cattle and chicken farms and other things are causing enormous problems with global climate change and with antibiotic resistance and with the origin and evolution of pathogens. They're a nightmare. Vegetarianism, if you're doing it from a political point of view, I can understand it. I'm not one but I can understand it.

Tim Ferriss: Just to underscore something for folks, if you avoid antibiotics but don't discriminate your animal protein consumption, you probably are taking antibiotics.

Jonathan Eisen: You are. Not probably, you are.

Tim Ferriss: What's important to realize, I think, among many other things, it's kind of a haughty way to start a sentence, but I'll start it that way, anyway, is that people say "you are what you eat," but you should take it a step further. Think of it as "you are what you eat ate." Having factory-farmed salmon that was given antibiotics may not be as good for you as eating locally grass-fed beef, for instance. Nor is it necessarily better for the environment. Taking it – looking at these, the secondary and tertiary steps is important, or preceding steps.

You mentioned a distaste for rules. I wanna talk about this for a second because how do you distinguish, and maybe you dislike both, this is a fine answer, but I find it very – for me to be maximally productive, I find applying constraints very helpful, using different types of constraints. How do you personally distinguish between rules that stifle versus constraints that enable?

Jonathan Eisen: It's funny. I just had a two-hour conversation with someone about this yesterday. I think that the difference is whether or not you're going to apply them blindly, or whether or not you're gonna apply them with an open mind and intelligence. The way I view rules is they're applied blindly. The way I view constraints, like you identified, is a slight difference in the probability that you would allow yourself to not follow them.

Tim Ferriss: Right. Right. So, one is the "I told you so – because I told you so" school of thought versus a sort of hypothesis weakly held or a guideline weakly held. Very interesting. What –

Jonathan Eisen: Then, just as an example, I'm a type 1 diabetic. Been on insulin for 30-something years. I have – I tried many times to have rules about don't eat dessert or do this type of diet or take insulin at this time. I found, certainly in my life, that I never can follow those rules anyway. It became completely stifling to worry about whether or not I was following those rules. Whereas, if I say, "Have dessert when you want it but don't have it too often and be careful about it," I view that as a constraint and it works much better.

Tim Ferriss: How did – if you don't mind me asking. How old are you currently?

Jonathan Eisen: Gosh, that's a good question. Should I know this? I am 46.

Tim Ferriss: Do you have any hypothesis or maybe you know how you – did you have type 1 diabetes prior to being 16 and it was just undiagnosed? Or did it have a sudden onset?

Jonathan Eisen: When I was almost 16, over a period of four or five months, I slowly started to waste away to the point where I was – had lost about 45 pounds and was probably within a few hours of being dead when I finally went into the hospital. The sad, funny, interesting part of all this is my dad worked at the NIH and was trained as an endocrinologist. I had mentioned multiple times that something's wrong. I'm really tired. I'm thirsty a lot. He was blind to the – he was a researcher, so he didn't practice much anymore. I knew something was going on, but I didn't quite know exactly what.

It's like the frog in the frying pan thing. For me, it happened over such a long period of time that I – by the end, it was ridiculous. I was going – I was peeing every five minutes and drinking forty liters of liquid a day to try and stop.

Tim Ferriss: Holy shit.

Jonathan Eisen: Completely ridiculous, right? It ended when I was on a backpacking trip, my first one of my life. I was putting my face into puddles of mud to drink the water. At that point, something finally clicked in my brain, like "This is wrong," and insisted on getting checked later that day when I was on the edge of diabetic acidosis.

Tim Ferriss: Wow. That's terrifying.

Jonathan Eisen: I was pretty messed up.

Tim Ferriss: What inspired you to become a scientist, if that's how you would characterize yourself? Obviously, you have a tremendous amount of scientific and research background. What inspired you to take that path?

Jonathan Eisen: I'm from a family of dorks. In particular, my grandfather was a physicist, did X-ray crystallography and other types of theoretical physics. He talked about science all the time when I was a kid. If you go back to what Jessica was talking about earlier, I was a birder. I participated in some of those citizen science bird activities when I was a kid doing Christmas bird counts and Thanksgiving bird counts. I got really interested in natural history because of that. I went to college and was an East Asian studies

major for a while, but I realized that I was too interested in biology. I took a course with Steven J. Gould on evolution and realized, "I can't do East Asian studies. I just love science. I love biology and I love natural history." That's what I view I'm still doing, natural history of microbes instead of birds. Same general idea.

Tim Ferriss: That was at Harvard?

Jonathan Eisen: Yeah, I was an undergrad at Harvard. I was taking Japanese classes. I was taking East Asian history courses. As a non-science major, you had to take some science courses. One of the ones they offered was this course by Stephen J. Gould. I had read a lot of his books, so I thought, "That's kinda cool." Within half an hour of one of his lectures I knew that's what I wanted to do.

Tim Ferriss: Wow! Talk about – that's quite an inflection point. You and I definitely, perhaps another time, have a lot to talk about. I was an East Asian studies major undergrad myself, focus on Japanese. Planned on transferring to the neuroscience department, specifically for a number of professors, Barry Jacobs chief among them. Could not – I think that animal testing is hugely important, but I could not bring myself to pay the dues in the lab which involved – I guess they call it 'perfusing' thirty to - bleeding to death, i.e. – thirty to forty rats a day. I was like, "God, I can't do it."

Jonathan Eisen: Thus you know why I work on microbes.

Tim Ferriss: They don't make a lot of noise when you euthanize them. What about, Jessica, what about yourself? How did you come to be – to found uBiome? What sparked that interest? How did that –

Jessica Richman: I came to this a lot later. I was always very interested in science. My dad's a chemist, and we used to talk physics and science and chemistry when I was a kid. I came to – I was very interested in science as a child, but I didn't – my early science courses was a lot of recreation of early experiments rather than doing your own experiments. My passion was always for doing – for learning new things based on science. I went a totally different route. I studied economics and computer science at Stamford. Then I got a fellowship to go to Oxford to study at the Oxford Internet Institute and then in other departments in Oxford.

I took computer science and economics and put them together to be computational social science, looking at the mathematics of

social networks, taking a different approach to quantifying human behavior. In economics, there are very specific mathematical approaches that are often used. I was frustrated with those. I thought, "Let's do something different that's still quantitative and is now called big-data or data science, but focusing on different computational methods to understand social science data."

I was doing a Ph.D. in that, and I went – I was part of a program called Startup Chile, which was a program to go down to Chile, the country. They give you $40,000 and a visa to Chile so you can become an entrepreneur and start your company in Chile. I went down there to work on commercializing some of the ideas that I'd had about social networks when I was – as part of my Ph.D. How you can measure social networks better. How you can determine which ones are more valuable than other ones. It was kinda interesting. Then I met my cofounder, who was doing his Ph.D. at UCSF in biophysics.

Tim Ferriss: This is Zack.

Jessica Richman: This is Zack. Zack was doing his Ph.D. in biophysics at UCSF, working with microbes, and doing some very similar types of mathematical techniques to what I was using in social science. Just sort of a plug for social science. This is a rare area where the methods are better in social science in a lot of ways because there are many more data points. If you're looking at data from LinkedIn or Facebook or something, you have millions of data points which is often hard to get in a biological setting.

We started talking about this, and I thought, "You know, I could take these same skills and apply it to something like genomic data where you could have this tremendous impact on human life." It's led, for me, into this passion for science and public health that was always kind of nascent, but I didn't – I don't know. The academic structures didn't help me to apply it in a way that felt meaningful to me.

Just the idea that you could take the same data science techniques that are used to understand LinkedIn data, which are interesting there, and there's a lot of value to be gained, but the microbiome is this whole other area of human endeavor. It's a whole new organ in the human body that had never been discovered before. Being able to take those same techniques and apply them to something that's sure to yield some impact on humanity was what I had to do.

Tim Ferriss: How, and without, of course, disclosing the secret sauce and anything you do not want to have public, where do you hope uBiome to be in three years? If you could comment on that. Or you can "no comment" it, that's fine, too.

Jessica Richman: We are pretty open about what our mission is and what we want to do. We want to gather – we want to involve the public in science by doing large scale studies that involve the public, and take the products of that research and turn them into useful things that people can use. We will probably not be the people turning them into those things, so through partnerships with pharmaceutical companies, consumer goods companies, other companies that can turn this knowledge into something valuable. This isn't selling people data. This is taking the insights we learn from the people who are giving us data, and then taking those insights and turning them into something meaningful. That's our focus.

This is a terrible example but I can't think of a better one. It's sort of like Shazam. Use Shazam to figure out what a song is, and they take that data, and they don't sell what songs you like to anyone. They sell what songs are trending, and what songs should you be writing. It's something similar to that. We will figure out what is going on in different populations over time through the cooperation with the public, and then we'll be able to take these insights and say, "This is clearly useful in this way and helps," and give that information to someone who can best make use of it.

Tim Ferriss: Very cool. The reason I backed uBiome is specifically because I'm waiting for you guys to develop the Rock in a pill. You know the professional wrestler/actor? I want to have his microbiome.

Jessica Richman: [Inaudible]

Tim Ferriss: Since he's like 347 pounds of pure muscle. I assume that will be replicable.

Jessica Richman: It's coming soon. Coming soon. I don't think we'll get the Rock in a pill, but I think there's a ton of really interesting and useful things that can be made from our understanding of the microbiome more quickly than in other realms. If you wanna take a whole other approach to drug development for cancer, for example, there's a tremendous amount of research and experimentation that needs to happen. We're sort of these natural laboratories for microbes in terms of us all having different ones that are doing different things. We can learn from that much more quickly, that's at least our hypothesis, than you can take other approaches to

learning about – to developing interesting products from the microbiome.

Tim Ferriss: No, definitely. I would love to ask a couple of odd questions of you guys. These are a little bit of a shift in gears. These are what I usually call the rapid fire questions. But that doesn't mean that the answers have to be rapid fire, but we can try. The first question – this usually isn't the first one that I ask, but Jonathan, I just love the fire in your belly, so I'm gonna ask this one. When you think of the word 'punchable,' whose face is the first one that comes to mind?

Jonathan Eisen: Jim Watson.

Tim Ferriss: Jim Watson! Oh, my!

Jessica Richman: Whoa. [Inaudible] that one.

Tim Ferriss: No, this is amazing. Please elaborate.

Jonathan Eisen: I don't know if you saw the whole thing about him selling off his Nobel Prize medal recently because he's so impoverished now because the whole world hates him after his racist and sexist commentaries that he made a few years ago associated with the talk, and now he just has to sell that Nobel Prize to raise some funds to buy a painting.

Tim Ferriss: To buy a painting?

Jonathan Eisen: Yeah, to buy a painting. That was one of the things he needed to sell the Nobel Prize for. Watson did some interesting stuff for a while, but in all honesty, he's kind of a deplorable character these days. I don't think there's anybody that comes to mind quicker than him in terms of punchable.

Jessica Richman: Wow.

Tim Ferriss: That's an ama – that's a fantastic answer. The painting must be very – have high nutritional value. Or very thick, for shelter.

Jonathan Eisen: Even more amazing, some Russian oligarch bought the medal and is giving it back to him.

Tim Ferriss: Wow. That's much more altruistic than I would usually assume Russian oligarchs to be. Go figure. Jessica, I'll come to you in a

second. Jonathan, what is the book or the books that you've gifted most often to other people?

Jonathan Eisen: I know the exact answer to this. I give it to tons of people. It's *A Field Guide to the Birds of North America* by National Geographic. It's the only book I give to people.

Tim Ferriss: Man, you are – these rapid fire questions are really working out here. Jessica, what about you for books?

Jessica Richman: That's a good question. I guess this is kind of boring, but I give Hemingway's *Short Stories* to a lot of people. I'm a big Hemingway fan.

Tim Ferriss: Why are you a big Hemingway fan?

Jessica Richman: He's just so – such an artisan of the story. His stories are so well-crafted. It's one of those things where you look at a work of art and you can't exactly figure out how they did it, but it's perfect?

Tim Ferriss: Yeah.

Jessica Richman: Yeah. I'm just – I admire the craftsmanship so much.

Tim Ferriss: There's not a lot of bloat in Hemingway's work.

Jessica Richman: No. That is true.

Tim Ferriss: If you're a Hemingway virgin, *The Old Man and the Sea* is a pretty good place to start, I think. *The Short Stories*, also fantastic. Jonathan, do you have any particular morning rituals? What is the first hour of you day or two hours of your day look like? Is it pretty standardized?

Jonathan Eisen: It's very standardized. My wife gets up first, and we have about an hour before our kids get up. Usually, we make coffee on a stovetop coffee maker, and we drink coffee, and we sometimes sit there and space out. Sometimes we talk about the plan for the day. Usually, our cat comes over and hangs out with us. That's what we do for an hour.

Tim Ferriss: When do you wake up?

Jonathan Eisen: Her alarm goes off at 5:55 in the morning. I'm sometimes up before that, sometimes up after that. We have about an hour before the kids get up.

Tim Ferriss: This is amazing. I may have a soul connection with your wife, which sounds weird to say since we don't know each other that well. Why 5:55?

Jonathan Eisen: I don't know. She really likes to have time to veg out and to think and to process before dealing with the ritual of getting the kids fed and off to school. I don't think an hour was enough, so an hour and five minutes is the bonus time.

Tim Ferriss: Wow. 5:55 – I don't know if I've talked about this publicly. I won't digress too far, but 5:55 p.m. was the time that I finished editing a book I wrote called *The 4-Hour Body*, which was a monster. It was almost 600 pages after cutting 250. It was the exact time that I finished my last line of editing in the book and was ready to mail off the final thing. I always take a screen shot on my iPhone whenever it's 5:55. It's sort of my good luck omen. Anyway, that's amazing.

Jessica Richman: That's awesome.

Tim Ferriss: Give a high five to your wife [inaudible].

Jonathan Eisen: I will take screen shots now when I get woken up by the alarm.

Tim Ferriss: That's gonna be a lot of screen shots.

Jonathan Eisen: I'm sure I won't be able to think well enough to take more than a couple.

Jessica Richman: Not photos. Screen shots.

Tim Ferriss: Coming from a family of scientists, how do you think about parenting differently from your non-scientist friends, if at all?

Jonathan Eisen: I'm not sure at all. We went through, when our first kid was born, our daughter, we went through the read a bunch of books, like they're gonna tell you exactly what you're supposed to do related to parenting. Most of it is something that worked for one person and it didn't necessarily work for us. Again, it goes back to that rule thing. If you follow those books as a rule, they're horrible. If you follow them as a constraint and guideline, they're pretty good.

My wife's also a scientist. She hasn't been working in the lab recently. We say she's a child developmental biologist. We're both scientists, and we have a lot of scientists in our background.

We try not to either force science onto our kids or obsess about scientific approaches to everything. We're much more holistic about how we deal with the kids. Holistic in the sense that we try to talk to each other about things and think of common sense approaches, as opposed to digging into every possible scientific study that could have been done.

Tim Ferriss: It also brings up a good point, the books on parenting comment. This is a good example of where media, I think, can get things totally ass backwards. They might say, "We looked at the data, and of 100 people who read parenting books and 100 people who didn't, the people who read parenting books turned out to be better parents. Therefore, parenting books make you better parents." It could just be that the people who are proactive enough to actually go buy books on parenting are going to end up being the better parents anyway because they care more, and so on and so forth. That seems to be the feedback I get from a lot of my friends who are parents. I am not yet, but I'm certainly looking for the Cliff Notes to the extent that I can.

One more question for you, Jonathan, and then I'm gonna start raining questions on Jessica for a bit. Is there a particular defining moment of your childhood that you can think of? Or was there a defining moment in your childhood that helped mold you into who you are?

Jonathan Eisen: We've already talked about one which was the – being moments away from going into a coma and dying from diabetes, which really had a massive impact on lots of things. But I think unquestionably I can tell you one very specific moment that had a huge impact on me as a child. When I was almost ten years old or just ten years old, we went to Kenya to visit my uncle who was studying baboons there for his Ph.D. in anthropology. He was doing fieldwork in Amboseli. We went camping in the middle of the Maasai Mara and other parts of Kenya, with lions wandering around outside.

One day, we were driving through the savannah, and my uncle said, "That's weird," and pointed way off in the distance to this gazelle that was doing something strange. We stopped the car and waited, and slowly over a period of maybe 15 minutes, a cheetah came from over where that gazelle was and walked about five feet from our car. Then we watched it do the cheetah sprint. It didn't catch the gazelle, but it did the full 60-mile-per-hour sprint. That moment was so awe-inspiring and transformative to me, to just think more about the natural world. I was kind of into birds then,

but I wasn't really thinking about it. But that – seeing the dynamic system in the savannah and seeing this incredibly beautiful, graceful predator coming out of nowhere – that – I still remember that moment.

Tim Ferriss: Wow. That sounds incredible.

Jessica Richman: That's an amazing story, I just have to say.

Tim Ferriss: What time of day was that?

Jonathan Eisen: It was in the afternoon. I don't know exactly when, but –

Tim Ferriss: I was just painting the picture in my mind because that's just like – wow.

Jonathan Eisen: It was incredible. By the way, as an aside, we're now looking into doing studies of the cheetah microbiome because I have to return to my roots.

Tim Ferriss: I was hoping you would say that you have adopted a cheetah and put a saddle on it like Harold and Kumar go to White Castle.

Jonathan Eisen: That, too, but I can't tell people about that.

Tim Ferriss: Legal only in several states, not all. Jessica, when you think of the word 'successful,' who's the first person who comes to mind for you?

Jessica Richman: Oh, wow. That's a really good question. There are so many different ways to be successful. I think – no particular name comes to mind, but what I really admire is when people have come a long distance from where they used to be to where they are. I think sometimes the people who have done that haven't come very far on a global standard, but they've come very far from where they used to be. I love reading stories about people who were in prison and then totally changed their lives. Or people who came from really modest circumstances and did amazing things with them. For me, thinking about that distance that people travel is what makes them successful.

Tim Ferriss: Okay. That's a good answer. I guess it's what – Hurricane Carter. There are a lot of many people who are inspiring in that sense. Who do you aspire to be like or to emulate as a founder or CEO?

Jessica Richman: That's a great question. I'm not – it's confession, I suppose. I'm not a big worshipper of the canonical Silicon Valley CEOs, Steve Jobs and Larry Ellison and even Sergei [inaudible] and Larry Page. A lot of these things are Six Sigma events that happened in a particular place and particular time, and slavishly saying, "Steve Jobs did it so it's a great idea for us," is not the best way to go. The people that I try to emulate are people that are one step passed where I am, not people that are ten steps passed where I am. They're probably people that you wouldn't necessarily know. They've gone to the next stage where I aspire to be, and then the next stage after that.

Tim Ferriss: That's fine. Any particular names? We'd love to hear some specifics.

Jessica Richman: No names are coming to mind. I do a lot of reading and talking to people, but no names are coming to mind. At least no one who would think it would be okay for me to name them on a podcast.

Tim Ferriss: That's all right. How do you find those people?

Jessica Richman: I find some of them through our investors. We find people that have been funded at the next stage or who have done the things that we are trying to do. I find them at conferences. Also, I find them by researching online and trying to think who has done the thing that I'm just about to try to do? Or maybe the thing that comes right after that and try to talk to them. You were talking about superpowers earlier. If I have any sort of superpower, it's that figuring out who is doing the next thing and being able to talk with them and learn what they know.

Tim Ferriss: That's a good superpower. What are the questions you like to ask such people?

Jessica Richman: I love to ask how things were done. A lot of these things, especially when they're reported in the media, are like, "So and so is an amazing CEO and they did this crazy thing." But when you actually find out how it happened, it's because their college roommate was doing it also, or their professor told them how to do it, or there's some trick that they know that nobody else knows. So, I like to ask questions around what that trick is. How exactly did this happen? Where did you first find out about it? What happened, specifically? I think that's how questions are really important.

I also like to ask values questions because I think that leads to a lot of interesting answers about what was fundamental to what happened as opposed to what was merely incidental.

Tim Ferriss: What would be an example of that?

Jessica Richman: There's a CEO that I sometimes talk to who has a company that has a strong culture. I ask him a lot about what was really fundamental – what choices did they – what things did they not do that they could have done, that they perhaps even wanted to do but they didn't do, in order to have the culture that they have. What things cost them? Where was there some sort of hard choice –

Tim Ferriss: What sacrifices did they make?

Jessica Richman: Sacrifice, exactly. What sacrifices did they make sound a little bit cliché. "I didn't go to the beach, or I didn't spend time with my cat." Or whatever. What I'm thinking about more in terms of sacrifice –

[Crosstalk]

Tim Ferriss: It was a dog culture. You gotta choose sides.

Jessica Richman: Exactly. I'm thinking more about things like what decision did it hurt you to make but you're glad you made it.

Tim Ferriss: Can you give an example of any of the answers?

Jessica Richman: Oh, yes. One particular answer is trusting the people around you in ways you might not necessarily think of to do.

Tim Ferriss: Like what?

Jessica Richman: In terms of having a company culture that's very open and very trusting of the people that you work with. For example, this is something that we try to do at uBiome. We have a lead day scientist we hired. He's a theoretical physicist. He just got out of his post-doc. He's never managed a team. He's never written code. He's never done any of these things, but we have him doing all kinds of stuff. He's hiring people. He's doing all kinds of things because he wants to and he can. I think there's a profound respect for – that I have and that I learned through these conversations based on letting people do the things that they want to do if they seem like they can do them.

Tim Ferriss: We can dig into that maybe in a round two. Jonathan, do you have any favorite documentaries or movies that come to mind?

Jonathan Eisen: If you want non-fiction documentaries, in terms of movies I've been watching over and over – *Shackleton* movie? It was a made-for-TV or cable movie about Shackleton. It's incredible. It's the best thing out there that is about the Shackleton story that currently exists right now.

Tim Ferriss: What do you like about it, this particular coverage or story –

[Crosstalk]

Jonathan Eisen: The story itself is remarkable in so many ways. I'm really interested in exploration. The great stories of all the explorers over time I read a lot of, and I think the Shackleton story, obviously, is pretty incredible because they were setting out to do one particular thing. It didn't work out the way they wanted it. Despite getting stranded on the ice and having a very high probability of death, they all survived. That's the amazing thing about the Shackleton story is they all survived. They managed to navigate across horrible waters with very few tools and traverse incredibly difficult circumstances. Over two years, even though they fought with each other, they did mostly stick together. It's this amazing story of human spirit and persistence and exploration.

I read a lot of these stories about Antarctica and Arctic exploration, and prior to that, exploring the world around us. The Shackleton one is pretty incredible.

Jessica Richman: This is weird because I have a soft spot for those kinds of explorations stories. I haven't watched the Shackleton documentary but I love the Beryl Markham and Amelia Earhart and that whole early flight stories. I'm kind of a geek about those. I wanna throw out a plug for a movie. I don't know if you've seen this, Tim. Have you seen the movie *The Edge*, with Anthony Hopkins?

Tim Ferriss: No, I have not.

Jessica Richman: This is a movie –

[Crosstalk]

Tim Ferriss: Oh, wait a second. Is this about the Indian motorcycle speed tests?

Jessica Richman: No.

Tim Ferriss: No. Okay, then I haven't –

Jessica Richman: This is about a – Anthony Hopkins is this perfect character. He's a billionaire scientist who's exploring the Arctic. It's this kind of out there setup where he's this billionaire scientist who doesn't spend enough time in the real world, and he gets lost in the Arctic. There's all sorts of interesting subplots. Basically, he needs to find his way back to civilization and kill this bear that's trying to kill him.

Tim Ferriss: I saw a pre – I saw a trailer for this.

Jessica Richman: It's so good. This is never – this movie is not famous. I don't know why. It has Anthony Hopkins and Alec Baldwin in it and Elle McPherson in it. You'd think it would be something everyone had seen. No one has seen this movie. It is my absolute favorite movie. It is this great story where not only does he survive by his wits and defeat nature, in a way, he also – his companions are not on his side. Not to spoil it too much.

Tim Ferriss: Yeah, no. Don't spoil it. I'll watch it tonight.

Jessica Richman: They are – they're not on his side, and he manages to save them, too. So, there's this altruism to it, as well. It's really good.

Tim Ferriss: I'll probably watch that this evening. Jonathan, I wanted to – I've not seen the documentary on Shackleton, but the – one of my favorite things, maybe my favorite thing, not knowing much about that story. One of my favorite things about it is the classified ad. I'm looking at a copy of it. The classified ad, this is what Shackleton used to recruit people to help in this journey is headlined "Men wanted." The subhead is "For hazardous journey, small wages, bitter cold, long months of complete darkness, constant danger, safe return doubtful, honor and recognition in case of success." Then his name and address. So amazing.

I feel like most job descriptions should have disclaimers like that. The turnover would be a lot lower.

Jonathan Eisen: In the movie -

Jessica Richman: I'm sorry, I was just gonna say one of our investors, someone you know, Tim, loves that ad and thinks we should put that in all of our job ads.

Tim Ferriss: I totally agree. Jonathan, what were you gonna say?

Jonathan Eisen: I was just gonna say, in the movie Kenneth Branagh is Shackleton, and there's this great scene where someone is coming in with that advertisement to apply for the job. It's completely – it's perfect.

Tim Ferriss: I heard that he was inundated with applications. I don't know if that's true or not.

Jonathan Eisen: They were drowning. They had literally got – they had to hire people to go through the mail because they got so many applications.

Tim Ferriss: That's so awesome. That's great. The great thing about that disclosure is that they can always pull out the "I told you so. You can't complain about the darkness. I fucking told you in the classified. This wasn't hidden risk." Jonathan, if you could change or improve one thing about yourself, what would it be?

Jonathan Eisen: Better organization. I'm not good at planning things or keeping everything organized.

Tim Ferriss: Do you think that the hatred of rules has – is related to that? Or…

Jessica Richman: Let's psychoanalyze Jonathan.

Jonathan Eisen: Should I lie down on the couch in my hotel room now?

Tim Ferriss: I'm not qualified.

Jonathan Eisen: I think that there's a very strong correlation there. Whether it's causal or not, I don't know. I do a really good job with getting things to happen most of the time, but I could definitely use much better – much more effort on a personal assistant or some type of planning.

Tim Ferriss: Now, this is – I don't let journalists follow me for what they want to be a typical day ever because I find – people expect me to be this paragon of efficiency, and I run my life like Spock, and it's this incredible –

Jessica Richman: You don't?

Tim Ferriss: – Swiss watch of productivity. If you came and watched me, you would ask yourself all day, "What the fuck is this guy doing?" But

despite all of my flaws, I get a fair amount done. It's for reasons that I could speculate and talk about, and I have talked about ad nauseam, so I won't do it now. You, Jonathan, you've done a huge amount accomplished, a huge amount. What allows you to compensate for this lack of organization and get a lot done?

Jonathan Eisen: What allows me to compensate for it most of the time is that I – maybe it is the lack of the rules. I have a big picture of what's happening in my lab and in the work I want to do and in the projects I wanna do. I'm not always obsessing with am I following the right path for a professor, or am I applying for the right jobs, or am I submitting to the right journal? I do what I wanna do. It's worked out really, really well for me.

I think that in research, I know a lot of colleagues who spend a lot of time worrying about what they're supposed to do as opposed to what they wanna do. I think because I don't spend a lot of time thinking about what I'm supposed to do, it works out a lot of the time that I get a lot done because I'm doing the things I love and excited about, and I never worry about what I'm supposed to do.

I confess, things slip through the cracks. [Inaudible] a bad approach. Most of the time it doesn't matter, but every once in a while it does.

Tim Ferriss: I like this. This reminds me of something that I read by one of my favorite writers, Neil Gaiman, who's a fiction writer. He gave a commencement speech. I think it was simply called "Make Good Art." He talks about, in this particular commencement, the big picture of moving closer to or further away from the mountain, which is this major goal he had of, I believe, it was being a full time writer. A lot slipped through the cracks, but because he had that one North Star, it sounds like as you do with the overarching goals of the lab or otherwise, he's been able to create this incredible career, even though a lot has fallen through the cracks.

Speaking of commencements, on a related note, and then I'll let us wrap up. This has been a lot of fun and I wanna be respectful of both your evenings. Jessica, if you were giving a few pieces of advice to your 20-year-old self, what would the advice be? And, Jonathan, I'll ask you the same as well after this.

Jessica Richman: My advice to my 20-year-old self would be about confidence. I think I've learned so much through working on my Ph.D., through starting this company, I've gained such a broader perspective. I think I just didn't have confidence in myself and in what I could

do, and in the level to which I could be pushed and still excel. I would tell my 20-year-old self to not be so afraid of trying things. That would – that's the number one piece advice. The second thing would be to think very broadly about what's possible. That's kind of related, but not only think you can do it but think about that there are many things possible in the world to do, that I don't think I thought of when I was 20.

All the standard, buy this stock or –

Tim Ferriss: Right. Buy Apple.

Jessica Richman: Exactly. Buy Apple.

Tim Ferriss: What were you so – why did you lack confidence? Why were you intimidated?

Jessica Richman: I've thought about this a lot. Some of this is the traditional female stuff, where – I see this all the time. When I see it in people, I always comment about it because I make a point of it, knowing about it. I was just talking to someone today who was like – this is our director of operations. She was like, "Well, you know, I don't know if I can do that. Maybe I should just wait and ask them if it's okay." I'm like, "No, no, no. Women wait and ask. Men just go do it and apologize for it later." It's true. There's this very female "Wait and you'll be rewarded." Like that CEO of Microsoft was saying, "Why don't you just wait and not ask for raises? Karma will give the money." They actually said that. I think we're socialized to believe that. I think that's a big part of it.

Another part of it was – I don't know. I think another part of it may have been socio-economic. There's this upper middle class feeling of power that I learned at Stamford that I didn't know before that. There's a sense that you can get close to see the power. I remember when I first came to Stamford, and I – you meet people that you read about in the news. I didn't know anyone before who'd ever met anyone who'd been in the news. You go to a talk and it's the Secretary of Defense or something, or it's Steven Pinker. It's somebody that you've read their books.

The idea that these were actually real people who were not perfect and didn't do everything perfectly – as a child I imbibed this very – my grandparents were immigrants after the Holocaust, and my parents grew up in that milieu in New York. There was always this idea that if you're perfect, if you work hard and you're absolutely perfect, you, too, can succeed. When I met people who

were the most successful people in the world and they had lots of problems, and were also very anxious about lots of things, I thought, "Okay. I can be one of those people."

Tim Ferriss: You're right. You're like, "Oh, okay."

Jessica Richman: I can do that.

Tim Ferriss: I get it. These are human problems not me problems.

Jessica Richman: Exactly. I didn't know that growing up, so that was a big revelation for me.

Tim Ferriss: I wanna underscore one thing you said. It's always a danger for me to say this because I look like American history X, so it's a sensitive subject. I was having a conversation once with a very, very, very successful female executive. The topic, this was a group conversation among friends, and the topic came up about salary discrepancies. Her thought, and I'm not saying this is the only, certainly not the only perspective, but she was massi – she makes millions and millions of dollars a year. She said the reason women make less oftentimes is because they don't ask for more.

Jessica Richman: Yeah. Studies have shown that. That's not just for…

Tim Ferriss: The asking for forgiveness rather than asking for permission, I think is a really important one. Jonathan –

Jessica Richman: I –

Tim Ferriss: I'm sorry, go ahead. I didn't mean to cut you off.

Jessica Richman: I was just gonna say. This is very controversial, Sheryl Sandberg's point about leaning in, but I think she's absolutely right. There are also structural inequalities and other things all through. But being able to not stop yourself is at least a first order – a first that you can take for – other people may stop you but at least don't stop yourself.

Tim Ferriss: Right. Right. No. Absolutely. Jonathan, what advice would you give your 20-year-old self?

Jonathan Eisen: I would tell myself to bank all my fecal samples.

Jessica Richman: Microbiome, obviously.

Tim Ferriss: They'd be like, what, in an ice cube tray? How do I do that?

Jonathan Eisen: So weird. Just like I don't plan things very well, I also am not very retrospective in thinking. The thing that I wish I had done more of and that I think would be really good, in general, is to trust good people and ask them advice. I have asked people advice over the years. When they're people that I really trust and people that seem to be good human beings, that advice has actually been really good a lot of the time. I don't think I've done that enough. I think that a lot of the time I try to work things out in my head through some logical flow chart or because I'm so damn smart, right? Asking for help from the right people is a really good thing and I wish I had done that more.

Related to that, something I also wish I had done more, and I try to do much more now, is to thank people who help you. There's lots of people along the way in life who do something small or something big who have helped me and helped everybody else in a lot of ways. In science, we stand on the shoulders of others. It doesn't hurt to thank those people.

Tim Ferriss: That's great advice. On that note, thank you both so much for taking this time. This was a really enjoyable conversation for me, and I hope that that's true for both of you as well. How can people learn more about what you are up to? I'll let – we'll go back to Jessica here. Jessica, where can people learn more about everything that you're up to?

Jessica Richman: As far as uBiome goes, you go to uBiome.com –

Tim Ferriss: That's with a U.

Jessica Richman: With a U, yes, I should spell it. U-B-I-O-M-E.com. Go to uBiome.com. There's interesting information about what we're doing. A blog is there. You can also purchase kits to better understand your own microbiome. All sorts of interesting stuff is on there.

Tim Ferriss: Just mailed one off myself, today. Back to you, yes.

Jessica Richman: Thank you. We look forward to receiving your poop.

Tim Ferriss: Are you on Twitter? Any other social media outlets?

Jessica Richman: I'm on Twitter @JessicaRichman. That's my name, J-ES-S-I-C-A-R-I-C-H-M-A-N, like a wealthy man. uBiome is also on Twitter @uBiome.

Tim Ferriss: Very cool. And Jonathan?

Jonathan Eisen: Everything associated with phylogenomics, that's my Twitter handle. My personal blog is phylogenomics@blogspot. My lab website is a phylogenomics WordPress site. The best way to find out about me is probably just Google phylogenomics, P-H-Y-L-O-G-E-N-O-M-I-C-S. Most of the stuff that comes up is something I've done.

Tim Ferriss: Awesome. Guys, this was a blast. I really appreciate it. Have a wonderful weekend. To be continued, hopefully.

Jessica Richman: Yeah, you, too. Thank so much for having me on.

Jonathan Eisen: Thank you very much.

Tim Ferriss: Thanks, guys.

Jessica Richman: Bye.

Tim Ferriss: Bye bye.

Jonathan Eisen: Okay. Bye.

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