**RedZone Podcast Episode #113: Simplicity is the Ultimate Sophistication with Dr. Jeff Karp**

Jeff Karp: 04:07 Thank you, it's great to be here.

Bill Murphy: 04:09 Well, I'm very, very excited to have you on the show. As my listeners have already heard about your biography and your history, I'm really interested in maybe starting with your entrepreneurship. Correct me if I'm wrong, but it seems to me that your focus on science and solving problems, you mentioned in your TED Talk, you thought that was going to be the hardest part of getting your ideas and your solutions out into the market. But you ended up talking about how the actual hard part was actually convincing others and the other part of the other entrepreneurial journey was equally as challenging. I was wondering if you could spend a couple minutes talking about that.

Jeff Karp: 04:49 Absolutely. I think in many ways, it's almost every academic's dream to have impact in society in some form or another. I think that there certainly is impact to be had in publishing papers and contributing to new knowledge. But I think also being part of using that knowledge to do something useful is incredibly excited. I think that in academia, we really don't have any formal training on the business side typically, especially us biomedical engineers or bioengineers. We constantly are talking about how what we're doing is useful, but actually putting to use the technologies and the knowledge that we're generating is a completely different world. I think that based on some of the mentors that I've had in my life, and my PhD and my post doc, they all were very entrepreneurial. They were all starting companies and interacting with companies. I just saw through these types of experiences the potential impact that one could have by dedicating to a career in science. But then also, by really putting a lot of effort into trying to push things out of the laboratory.

When I set up my lab in July of '07 after coming out of a post doc from Bob Langer's lab, really trying hard to figure out how could I continue the mission that I had learned from my mentors about the potential of translating academic discoveries into new companies. And ideally, quickly turning that into products for patients. One of the things actually I'll say that I think is one of the best decisions I've ever made in my life is that around the time when I started my faculty position, I realized what I wanted to do, but I knew I didn't have the experience or tools to really do it. What I committed to was meeting somebody new in the entrepreneurial ecosystem here in Boston every two to three weeks. I continued to do that over the past 12, 13, 14 years or so, and this is reimbursement, regulatory experts, entrepreneurs, people in companies, manufacturing experts. And really trying to develop relationships with people. That has served multiple purposes that have helped me to stay on track for the mission of trying to bring new therapies to patients as quickly as possible.

Bill Murphy: 07:23 Yes, I find that fascinating, the mentors that you mentioned. Originally, you mentioned some mentors within the academic arena, but those mentors were also entrepreneurial. How do you go about nurturing, and finding and developing these mentors? Because I often say in my innovation group that ... again, I don't know how we measure this, but it's been said that we're the average of the five people we hold closest to us in the area that we're looking to expand and grow in. How do you continue to challenge yourself with finding mentors that help you think in new ways?

Jeff Karp: 07:53 I think part of it is developing ... in some ways, I think it's almost developing a passion to have mentors in your life. It's one thing to say it's good to have a mentor, but I think unless you're really excited about it and really motivated to have one, there's a certain activation energy required to really seek out, I would say, mentors who are a good fit for you. One of the best definitions of mentors that I've come across is someone who's hindsight can become your foresight. I think along with that goes someone who actually sees your potential and almost treats you as if you're at that level, so they can help pull you up to that level.  
I think in an ideal world, your boss, or your supervisor or whoever's overseeing what you're doing would be your mentor. I think a lot of the time, that doesn't end up being the case because not everyone's really passionate about mentorship. To me, recognizing early on that it was going to be a critical part of my life and that there were things I wanted to do, but just didn't have the capabilities to do certain things. I knew I needed to work with more ... I see a mentor as a life coach. Just by becoming passionate about finding mentors, I think that actually played a really big role.

The other part of it I think was just really seeking out people where the relationship seemed right, and people were taking an interest in what I was doing. At the same time, maybe they could see that their advice and their time with me would be put to good use because I would take what they said very seriously and really try to implement these things in my life. Having mentors has really been a big part of my life. I'd say the other thing is, I'm a really big believer that anytime you want to learn a new skill or become proficient in a new area, the best way to do it is to find an environment where people are practicing those skills, and then submerse yourself in that environment, even if you have no expertise or skills in that at the very beginning. That's also been something that I tried to do is really seek out environments where people were practicing skills that I just really wanted to have because I knew it would help me in my path.

Bill Murphy: 10:13 Were the mentors that you were particularly successful ... that had helped you. One of the things you mentioned is you seem to have a big reason why you want a mentor, or surround yourself with mentors. Is part of that the natural strength you had in the sciences and the need to shore up skills on the entrepreneurial side of the fence? Or did you find that you wanted mentors in both continuum? You wanted it both in the areas that you were naturally strong, and also areas that you were naturally needing to develop more skills with. What are your thoughts on that?

Jeff Karp: 10:49 Yes, it's an interesting question. I don't know if I have a really linear answer I'd say because ... it's almost like I feel like it was just a growing passion, a feeling inside, and almost an awareness of what were my strengths and what were my weaknesses. I had a lot of support growing up from my mom. I struggled a lot early on in school, and that support that I got from my parents really helped to instill confidence in me that there's something that I could do that would be useful. I think that through the various struggles I had early on in my childhood, I think seeking out other levels or different areas of support I just knew was going to be helpful for me to try and unleash the potential that I thought I had.

This process I feel is just very iterative. There's no ... you can't say that you want this person to be your mentor and it will just happen. I feel like it's just having lots of interactions with lots of people and just getting a sense for when there's a good fit. I think that was to me a big part of it. And then the other part of it was, as I went on in the early parts of my career, I realized that what I wanted to do was combine engineering with medicine in a way to develop new therapies. I really didn't know how to do that, but I saw others do it. That was very inspiring to me that it was possible. Then I started to really just start seeking out environments that I could submerse myself in to learn those skills.

I'd say it was more about not having a specific plan or knowing how to advance, but just knowing that that's what I needed to do and really wanted to do. It was developing that passion and then just seeking out interactions with people to find the right conditions to fulfill that.

Bill Murphy: 12:49 That makes sense. You had this very strong passion, and then really, that was the guiding north star. Then in the journey towards that objective, you were learning from others as you went that you pulled into your vortex, so to speak.

Jeff Karp: 13:03 Exactly, Yes. I feel like everyone has so many different experiences in their lives. It's hard to ever appreciate how different other people's experiences are or have been, and the lessons that they've learned, and the life strategies that they have and that they use on a daily basis. I came to this appreciation that I could learn a lot from everybody, and that every interaction I had, there's an opportunity to learn something about myself, or about a strategy that they were using that maybe I could try and experiment with in my own life. I'd say throughout my life, I've experimented a lot, not just in the laboratory and the research that we do, but also just in the strategies that I've tried to develop to maximize productivity and impact that I could potentially have in the world.

Bill Murphy: 14:01 Well, there is very much a vulnerability and a humility that comes through mentorship because you're essentially acknowledging, just by embarking on the journey of learning from others, that you don't have all the answers. I found that myself as I've searched different people that have achieved different things. You're by definition saying, okay, how is someone else, what's their lens of reality as compared to mine? Maybe there is another two, three, four different options to achieve this. That leads me to my next, because I think the humility of really, really smart people that have done quite a lot, you also talk about the value of that's not the end game. The end game is actually simplifying. I was hoping you could talk a little bit about what value your lab and your thinking and simplicity has taken ... and how that started? How you deploy that mindset in a very, very complex environment?

Jeff Karp: 15:00 I think simplicity, it's become a very important topic in my laboratory, and I'd say broadly in my life. It wasn't always that way. There were some notable moments, I would say early on in my faculty position, where I learned lessons, I'd say, even the hard way, that really helped me change my thinking or get to a different level of thinking. That was I was always curious about why so many academics in the biomaterials or bioengineering community were developing seemingly very promising therapies and technologies, but very few things were actually being translated to the clinic. To read these papers, and in the abstract or introduction conclusion, you say this is going to be useful for X, Y and Z. But then nothing really happens. Nothing advances to clinical trials. I was always curious about why that was.  
Early on, the initial project that I focused on in my laboratory was in the area of stem cell therapy. We were interested in trying to find ways to modify or manipulate stem cells outside the body where we could control the surface. So when we infuse them back into the body, let's say intravenously, that the surface of the cells could recognize signatures on blood vessels, so they would slow down and stop depending on where they were in the body. It was almost like this GPS system. We actually got it up and running. I was pretty excited about it, so we could do intravenous infusion of stem cells and have them localize or target a site of inflammation, just by traveling through the bloodstream and through actively interacting with the blood vessels at the site of inflammation.

I went to a local venture capitalist really excited about this. I thought we had done something really great. We started talking, and then I went through the data. They said, "This is really interesting work and you really achieved something nice." And then when we started talking about how I got to this process, it's a five step process. They took a look at it and they said, "While the data looks really interesting, this is going to be extremely difficult to manufacture because there's so many different steps. You're going to have to do quality control at each step. In our experience, the more steps you have, the greater the risk of not being able to fill certain quality criteria, and things can really break down." Then they said, "If you really want to impact patient's lives, you need to come up with simpler technologies."

I went back to my lab, and I was frustrated and disappointed, maybe a bit angry. I was like, ugh, why didn't I think of this before? I really thought deeply about that feedback, internalized it, and realized that when I started to ... It's interesting because I feel like when you learn a hard lesson, you have a new lens at looking at almost everything. As I started to look at other technologies that people around me we're developing and things going on in my lab, I realized that yes, a majority of the things out there were just too complicated and there was lots of opportunities for simplification. That set me on this mission of how can we simplify everything we do right from the beginning, so that we're not spending years developing something and then trying to simplify it at the end, but actually making simplicity part of the design criteria for the solution?

Bill Murphy: 18:28 Yes, because in your speech, you mentioned the radical simplicity is the art and discipline of reducing a problem to its essence so you can solve it quickly, and then develop practical, and can be practical in the real world. You also mention about these deep nuances in thinking. I think that's the challenge I find with technology these days is infinite growing complexity. We often are wondering, okay, well, we're developing these different tools to help with complexity, different tools that are automated, like machine learning, and AI and different algorithms to help us. But there's a natural human governor of, okay, how can I take this and make it into a more simpler outcome? Maybe you can talk about that with your lab and the process that you're developing because I think that's a conversation people want to know, is how I can be innovative, and how I can have a team that innovates. Even though you might be the one that pours the gasoline on the fire, I think my listeners would be really interested in knowing how your process works in your labs for making these breakthroughs, or the structural process.

Jeff Karp: 19:39 Yes. A lot of this has just been really highly iterative and really trying to ... Actually, there was another realization that I made as I was thinking through simplicity early on, which was that it doesn't just apply to the technology side of things. It's not just about trying to just think technology, but rather, it almost encompassed the entire spectrum of translation. Even in terms of how the problem was defined. What I started realizing as I was, I'm an engineer by training, and I think an engineer in many ways is a degree in problem solving. That has led me, in combination with some of the things that, some of the experiences I had earlier in my life, to really focus on the process, and really try to understand how altering the process can really impact the product at the end.

When I started thinking about the process of innovation ... by the way, I feel innovation is something that can only be retrospectively defined. Innovation is a very practical word, meaning that you've actually done good or contributed positively to society. So you can't really call something innovation until you've actually done that. Actually, that definition in and of itself helps us as well because we can get enamored very quickly with something creative thing we come up with, but that may have no potential to help patients. In terms of thinking about the whole spectrum, what I realized is that the problem needs to be thought through at the beginning. And the problem isn't just a biological problem. It's not just a medical problem, but it's actually commercial problem as well. The business side of how you're actually going to bring this forward, and get investors, and really make this into a viable product is part of the problem definition that needs to be considered right from the beginning, as well as the manufacturing and the regulatory strategy.

It was almost ingrained in my mind that the problem was really just biological problem or a medical problem. And if you succeeded in curing the mouse or the animal, that that would be enough to bring something forward. Then what I realized is that I needed to do a lot more critical thinking early on about the entire translational spectrum. That's been a big part of the radical simplicity approach is not just simplifying the technology, but really trying to get at the heart of the problem. I've realized that often, the way that others have defined problems is that there's actually more that we can do, that there's more to the problem than we can read in a paper or have a conversation with someone else. Often, what we'll do is we'll conduct experiments to better understand the problem, and then to gain ideally some insights that may help guide us in a direction that no one's gone before.

That's been a big part of this radical simplicity paradigm for me in my laboratory. And then there's also a lot that I've tried to do in my lab to maximize a culture which would really enable people to explore their curiosities and have somewhat of a limitless type environment, which I think has also been very important in combination with that.

Bill Murphy: 23:00 Could you talk about that a little more, about the culture part? Because as you mentioned earlier, it's not all about the technology, and culture for me talks to people. I'd love to hear your thoughts on culture and supporting these big moonshots that you're developing.

Jeff Karp: 23:14 Yes. Culture is something that I feel like ... You hear often how important it is to have the right team and the right people. That makes a lot of sense, but to me, the challenge is how do you actually execute on that? That ends up being a lot more challenging and complicated than just talking about having the right team. I've tried really hard through my career to figure out what is it really about productive and impactful, successful cultures where people really gravitate towards? What are so the elements of that? And then experimenting in my laboratory with ways of trying to empower people, and to really create a culture where people go all in.

Some of the aspects of that, I feel one is just hiring and bringing people to my laboratory. I read this article early on about how when you interview people, you tend to hire yourself. I was like, really? I don't know. And then the next time I was interviewing someone, I realized, that's exactly what I was trying to do, and that I was judging people based on whether they aligned with who I was and how I operated. I quickly realized that I needed to engage other people in my laboratory to be major parts of the hiring process. What I also realized is that I'm not necessarily the best judgment of character. I look at everybody and I see a lot of potential, and I have trouble saying no sometimes to people. What I realized, there's actually people in my laboratory who are exceptional at judging character and who's going to fit into the lab and really create a lot of synergies. So, the people in my lab can actually veto me on bringing someone in. If I'm excited about someone and they say no, then no is the answer.

I feel like a big part of that is if the people in the lab are excited about someone coming, if they have a say, they're likely not to pick someone who's going to be competitive. They're more likely to pick people who can synergize with what they're doing and bring their science or their projects to a new level. And then when we accept somebody into the lab, there's this excitement that that person's coming. I think that that's really contributed to an important part of the culture that we have in the laboratory.

Another thing that I've tried to do is really focus on empowerment. So, trying to figure out ways where people could pretty much own their projects, that it's not my project, it's actually their project. And that it's not an environment where people really work for me, it's an environment that it's almost like the opposite. It's like I'm working for the people in the laboratory, trying to create more of a lateral environment, which has been a challenge, but something that I've really worked hard on. I'd say an example of empowerment is, part of it, I think, is dealing with ego. Then what I realized through really trying to become self-aware is that in general, I think when faced with certain types of decisions, ego jumps out and tries to make the decision, protect thyself type of mentality.

What I've tried to do is prevent that by thinking about, well, if I made the opposite decision, would that actually harm me? Would that lead to a positive outcome? In many cases, going against that instinct of protect thyself, I realized that I can really create more of a win-win environment. And that if you create an environment where you really appreciate what others are doing, and try not to limit them, and try to give them ability to own their projects and empower them, that people are more likely to go all in. You see even these very young individuals who quickly develop a steep learning curve and their professional development really skyrockets.

One other thing I'll mention that I've done, which I think has really been helpful, is in my laboratory, we do these three minute presentation competitions. We've been doing this for probably the last 10 years or so, where everyone in the lab has an opportunity to present for three minutes. They ideally present on something that they're curious about or passionate about, doesn't have to be science related at all. And then what we do is, after each presentation, everyone in the lab can provide feedback on what they liked about the presentation and what they thought need improvement. Then what happens is that everyone votes on who gave the best presentation and who gave the best feedback to improve quality of the presentations. That's just been incredible because it creates, again, it's towards this lateral environment. It really facilitates people get in touch with their curiosities and their passions.  
It's an amazing thing because people ... We had a guy present with, he had a guitar, and he was playing, and his slides were going on in the background. He was into break dancing, talked about break dancing and did a break dance. Someone did a rap on the various hamburger restaurants in Boston because they just like to do these raps. And then someone actually recently, a few weeks ago, someone presented on how that song, the Baby Shark song, is so addictive. She has a young daughter, so she presented on that. Again, I feel like that just, it's creating this community where people are all on the same page, and they're all helping each other and inspiring each other to take risks in a very safe environment to do that.

Bill Murphy: 28:52 Yes. That three minutes in front of people, it's a natural human tendency to really be afraid of speaking. You've made it a transformative experience for people. It's really interesting how you challenge your ego with a question, instead of letting your brain take over with that fear response and that defense mechanism, you actually ask the question, what if I did the opposite? That's a very powerful way you've jumped and taken a hold of the brain before it can take over you.

Jeff Karp: 29:22 Yes. I feel there's so many things like that, just these instincts and knee jerk reactions. What I've also realized is that by choosing the environments that we submerse ourselves in, and by stopping ourselves in these types of ways, that we can actually alter our instincts. We can actually control the instincts that we have. It does take time and it takes practice, but over time, I've realized that I can create habits that are not ego driven and that are really habits that I have self-imposed in my life and have control over to say this is what I really want. And I don't because I feel like sometimes, these knee jerk reactions, they're things that you're like, where did that come from? That's not what I want, that's not the reaction that I feel I want to have or that's really me. I think for whatever reason, these things are there. It's a matter of trying to figure out how to control them to serve the purpose that we each define for ourselves.

Bill Murphy: 30:28 In your environment, how do you define high performance teamwork? Is it because you're able to get potential technology solutions out of your lab and into the commercial environment? You're translating problems to the commercial application? Is that the checkbox that you're looking for, or is there multiple check boxes that you're looking for all along the way that the team's measuring against? I'm curious in how you define a win in your environment.

Jeff Karp: 30:58 I think the translational process is quite a rocky road, and a lot of challenges, a lot of barriers that you hit along the way, some that seem even insurmountable. You're just not going to be able to go past it. The long term vision for every project in the lab is to be able to positively impact patient's lives in the shortest period of time; but often, that can be a very long road to do that with many major roadblocks along the way. We realized that there are opportunities to get excited, and for those ... we need to have boxes, as you have defined it, along the entire path.

I think a lot of that for us is, if we can uncover some sort of insight about the problem that others haven't figured out yet, or that's different, that may seem promising to lead us down a direction of technology that has potential of working, we get excited about that. That's a box, to learn something new that we know is different. I think also, when we encounter a challenge in a particular project, often you get frustrated and angry, and try to figure out maybe we shouldn't advance this. But I think that can also check a box because when you encounter a challenge, it's like an opportunity to be creative and to think differently. I think in our lives, we have so many limitations that are imposed on us by others and ourselves, even the buildings that we work within. We get into these habits that just are very limiting.

My sense is when we take away those limitations as much as possible ... One example is in my laboratory, I've tried to have multiple affiliations with different institutions that provides access to resources, so we can access tools, and different technologies, and almost anybody to engage and to advance beyond things. That creates excitement. So when you encounter these challenges, if we can then find a collaborator, or find a new tool, or a new way of thinking that we can go back and test, then that can really electrify the team. I think to me, those are the kinds of things that I look for along the way because I know there's going to be lots of frustration and challenges that we hit. And it's important to keep the team motivated and focused on the vision of where we're headed. I think finding a collaborator who can just help us think a little bit differently can immediately flip something from being frustrating to something that all of a sudden is exciting again. I think that's also been a big part of it.

Bill Murphy: 33:51 Elon wants to go to Mars and he wants to have electric cars. He has these big moonshot things that are very public. Within your lab, do you have a vision, or a mantra or a mission that you're trying to impact a certain amount of lives? Are you trying to revolutionize or ... or is it multiple missions that you have depending on which problem you're solving? I'm really curious to see how you create that environment from, "Okay, here's what we're trying to do, everybody," from a leadership perspective.

Jeff Karp: 34:22 I think that one of the things that I've realized is that, going back to simplicity, that I needed in my life to have very simple mantras. It couldn't be too complicated or involved because it just wouldn't fit me. One of the things that I learned through my mentors, in particular spending time with Bob Langer, is that one mantra that can really serve well in making decisions is maximize impact. Just those two words, if I think about that constantly and I really make that the mission of everything we do, that that can help me to make decisions of how to spend my time, and how to engage the process and really think through the best way of making decisions.

I think that that's how I would answer your question is that there is no ... at this point, we don't have any specific disease focus in the lab and there's no specific technology focus either. It's really focusing on the process of medical problem solving and maximizing impact in everything we can do. Just constantly looking for new problems and getting into new areas where we think we might be able to make an advance, or we might be able to uncover some new insights that can guide new ideas for technologies. We do work in cancer, and arthritis, inflammatory bowel disease, a bunch of surgical tools, inflammatory diseases and traumatic brain injury. We work in a lot of different areas. I think a big part of that is I just love learning about new things. It's just something that I recognize that I need to keep my mind active like that, to be fulfilled, essentially.

Bill Murphy: 36:16 I love that.

Jeff Karp: 36:18 Yes.

Bill Murphy: 36:19 I love the maximize impact because as you were mentioning, you have a wide interest area, and it is a catch all sieve for you to catch and have a lens that you can ... what I love is, just from my entrepreneurial brain, is that you can constantly ask that question to yourself quietly, and it helps you organize where you're putting resources of personal time, energy in the team.

Jeff Karp: 36:42 Absolutely. I did have on example of maximize impact that I realized has been important as a decision maker is, sometimes we'll publish a paper, let's say, and we'll spend a couple years writing it. Maybe it's a review paper, and we publish it in a good journal. And then we'll have a bunch of other journals or books reach out to us and say, "Hey, we saw you write this. Would you do something similar for us?" I used to say yes and do those types of things, but as I think about it more, I realized that that's really not maximizing impact to write the same thing and just reword it. And that what maximizing impact would mean would be starting over and doing something completely different, where we can learn something new and really critically think through the process, and then offer some new insights and ways of thinking for the field.

I feel like it's interesting how there's so many others out there who are, and groups, that are trying to take up some real estate in your mind, and divert some of your efforts into these directions, which may not actually be aligned with what you really want to do. That's why I feel it's important to personally have a life strategy and to work on it, because as these opportunities come up and people present things to you to ask you to do certain things, you can then use this concept of maximize impact, and what you've defined for you is really going to be most fulfilling to make those decisions.

Bill Murphy: 38:16 Yes, that's why I've always love podcasts because the audio format hasn't gone away. I think we all thought radio was going away, but it's just morphed into a different form. What I love is these become mentors. As people listen to you talk, they can become the quiet mentor in the background because your MTP, your transformational purpose, you're maximizing impact, that just becomes the catalyst for others that are listening to you. That's really, really powerful. Maybe I thought what a good way to wrap up our show today, Jeff, is I'd love to ask you a question about stem cells and about ... I know these aren't necessarily related, and I'm not a scientist, so you can help guide your response. But I'd like to talk about stem cells in the gut biome, just your thoughts about a particular ... for example, my three children, I think the thing in 2001 was once the child is born, my kids are born, we shipped the placenta down to get it stored in some place in Florida for potential use for stem cells. This was 2001.

I asked my wife the other day, I said, "We still have those, right? We still have the stem cells stored?" She's like, "Oh Yes, we pay yearly a fee for that." I'm really curious about the gut because I've heard it said that the gut and the research on the gut biome could potentially be as impactful as finding another organ in the human body, as far as how it's related to the brain and overall health. I know I'm not a scientist and not everybody listening is a scientist, but I'd love to get from you what your thoughts are on those two areas to leave us with.

Jeff Karp: 39:50 Sure. I think the field of stem cells and regenerative medicine is a really exciting space. I think there's huge opportunities. Some of those are being realized in the potential in clinical trials right now. I think we have some very ... one of the most successful stem cell therapies is hematopoietic stem cell transfer, or bone marrow transplantation for patients who have anemia or certain types of blood cancers, where you take the stem cells that can make blood and they end up being a therapy that's been widely successful, has a number of complications, but that really has saved a lot of lives. I think that it's interesting that you bring up banking of placenta, and also cord blood has been another tissue, if you will, that's been banked in quite large numbers.

It's interesting because early on, the sense I think was, by the experts in the community, is that this would have very limited use because there weren't that many examples where, if you have a certain blood cancer or if you have a certain type of anemia, that yes, these could help, but there are a lot of other conditions that there wasn't any proof or support that stem cells could really help. There was a lot of skepticism. I think what's going to happen over time is that as the field has evolved, that we've realized that there's a lot of other opportunities for these cells if you bank them early. With age, our stem cells and just cells in our body tend to have more defects and abnormalities over time through the aging process. That can be from the environments that we expose ourselves to, as well as genetics. Having cells be banked at a very early time may unlock some potential new approaches that we haven't even thought of yet.  
For example, I think there was banking of these cells, and then the whole field of reprogramming came in. The sense was, I think, the data suggests that if you're going to reprogram cells and use them for regenerative medicine applications, it's best to start with cells as early as possible that don't have any genetic or other type of environmental type defects. I think that space is pretty interesting. There's the whole business side of it as well. I think that the business side and the marketing can be such that it turns off a lot of academics or some of the experts in the field. But I think over time, you realize that banking these tissues may actually make more sense than they did five or 10 years ago because of the new opportunities that have been unlocked.

I would say in terms of gut microbiome, the field, I think we're just in the infancy there. I think we know now that the bacteria that inhabit our bodies, and in particular, our GI tract, and specifically in the colon, can have a lot of interactions with immune cells in our body, and with the cells that line our GI tract, and can actually play a role in several disease states, as well as healthy physiology. I think it's incredibly complicated because there's so many bacteria. It's a whole new universe, really, to explore. There's been a lot of interesting correlations that we've found. I think the field is the point now we're trying to figure out, if you remove this specific bacteria, if you add this specific bacteria, can you improve the quality of life of somebody? And how to think about that on a per patient, personalized approach. I think we're just at the beginning and there's incredible potential. It's just a matter of unraveling that complexity and really finding opportunities to harness this to improve quality of life of people.

Bill Murphy: 43:45 Yes. Thanks for giving everybody such an understanding, because separating the marketing hype from ... like you're saying, it's a big universe and we're unlocking it, but it's not ... we haven't yet figured everything out.

Jeff Karp: 43:58 Yes, absolutely.

Bill Murphy: 44:01 Well, Jeff, I really appreciate you for coming on the show today and sharing your approach, and how you are able to accomplish these really big objectives. And through your teams that you put together, and your thinking, and your mentorship. It's really inspirational. Is there anything that you would like to, any thoughts that were triggered during our conversation that you wanted to end with, or any final thoughts on today?

Jeff Karp: 44:29 I've enjoyed this conversation quite a bit. Thank you for the questions that you've been asking. I always find that talking to different people, everyone asks questions differently and has different things that they're interested in asking. I feel like that process in and of itself pushes me to think differently, and to think of things that I may take for granted, or may not be at the top of my mind every day. I feel like that just leads into something I feel is really important, which is I'm just constantly experimenting in my life, and trying to learn from others, and from trying to unlock the various processes that others use, and that I use. And just to try to continually improve and figure out better ways of doing things.

I think that's just a big part of it. I feel like we're never there. We never reach the top of the mountain, so to speak. We're always climbing up. I feel like that's a really exciting place to be, and I'm excited to continue to have conversations like the ones that we just had throughout my career to just provide new insights, and new ways of helping us to advance our mission of helping patients in the shortest period of time. And then also, supporting the professional development of the people in my laboratory and those that I work with.

Bill Murphy: 45:51 That's really inspirational for what I'm getting, and from listeners, is just the process that you look at these multiple peaks, and these different companies that you've got to market, and these different therapies that your teams are develop ... It's so many accomplishments, but you don't look at them as an end in and of themselves. I think that's a really big learning point for listeners is that there's a continual, ongoing learning process that you never really achieve what you think you're going to achieve. You just move onto the next learning point, the next objective. That's life. It's amazing, I find, to listen to highly accomplished people like yourself, which have this marathon, not sprint mentality. It's quite refreshing.

Jeff Karp: 46:31 Thank you, thank you. Yes, I think trying to shift the focus ... clearly, we're focused on the end goal of helping patients. But I think by really focusing day to day on the process, and different ways that we can maximize our excitement, and just uncover new knowledge, and unlock potential. I think by making that the focus, I think it really sets us up for a long career of maximizing fulfillment be we're not just thinking about the end goal, but we're actually focused on the process along the way, and constantly trying to improve it, and maximize the excitement we can gain from uncovering something new.

Bill Murphy: 47:16 It's been an amazing conversation, Jeff. I really appreciate you for your time and look forward to, in the future, doing a round two.

Jeff Karp: 47:23 Sounds great. I look forward to that as well. Thank you so much.

Bill Murphy: 47:26 Have a great day, Jeff. So, there you have it. This wraps another episode of Bill Murphy's RedZone Podcast. To get all the relevant show notes, please go to our blog at www.redzonetech.net/podcasts. Additionally, make sure you go to iTunes and leave your comments in iTunes about the show. This helps our show rankings enormously, and it helps support the show. Until next time, appreciate you very much for listening. Thank you.