Announcer: Bulletproof Radio, a state of high performance.

Dave: You're listening to Bulletproof radio with Dave Asprey. Today is a special live recording. You may hear the ocean in the background because I'm here at the X Prize event which Bulletproof is sponsoring, and I got a chance to interview Dr. Bob Hariri who is an amazing human being, a personal friend and someone who just got off stage. He's got 30 years as a neurosurgeon and a medical entrepreneur who's done a huge number of startups, innovating at the very forefront of how we can get control of our own biology, both medical stuff and now some things that are quasi medical that are tied to anti-aging, longevity and stem cells particularly a company called Celularity which is pioneering some of the new ways we can live a lot longer than we thought we could. Bob, welcome to the show.

Bob: Dave, it is as always great to see you and thanks for inviting me.

Dave: Bob, on stage here with Peter Diamandis, you just talked about some incredible things that you think we're going to be able to do over the next even 10 years to radically extend what we call the human health span, and you said something that really caught my attention. You said 100 is the new 60. What does that mean?

Bob: You know Dave, we have been working for more than the better part of two decades on turning living cells into medicines. On that journey, we recognize that the way a stem cell exerts its biological power when used as a therapeutic is to in essence reprogram a system, and that's really useful when we're trying to go after cancer by using immune cells that can specifically target, identify and destroy a cancer cell. It's useful when you use these cells to modulate the immune system, to turn off inflammation or turn off autoimmunity, but it's also really valuable if you want to change an aging phenotype. an aging form into a more youthful form. So, I became curious about this maybe a decade ago and started to study some simple relationships, the number of stem cells in your body as a function of age and whether the stem cells in your body decline qualitatively as well as quantitatively with age.

Bob: Lo and behold, that's what we've actually shown. So, the obvious next experiment to do was if you're losing stem cells as you age and that's one of the reasons why you develop the symptoms of aging, why not give yourself stem cells back and see what happens? Some of the early work was really compelling. We showed that in experimental animals, the number of stem cells in every organ and tissue declined with age. If you replace them, you can actually extend the lifespan of those animals. So, where this is taking us in the future is we want to develop a toolkit that would allow us to safely, reliably and repeatedly boost the regenerative reservoir that resides in our body by getting a dose of cells that that literally restore this youthful phenotype.

Dave: Four years ago, I had my first stem cell treatment where Dr. Harry Adelson pulled some fat out of my own sort of lower back area, made some stem cells from it or more likely extracted them and then injected them intravenously into some sites of injuries I had and they all went away. All the areas of pain stopped, and since then, I've done a ton of stuff and I haven't tried the things that you're making yet which I'm excited to do. Maybe two weeks ago, I had a half a liter of bone marrow pulled out through both hips

and we use that in every joint in my body and things like that, but this stuff is relatively expensive. One of the concerns that I have is that right now this is cheaper than joint replacement and it might prevent it. So, it's actually if insurance would cover it, it's actually a better use of funds and you don't have to have replacement parts maybe which is a good thing, but when is the stem-cell universe going to be open to all of us versus just the people who can afford it now?

Bob: So, first off Dave, I've known you a long time and you're tougher than nails if you had a half a liter of bone marrow collected because I know that's not fun.

Dave: We blended it with coffee and I drink it right down.

Bob: Another great product line. So, you're hitting on some very important points. First and foremost, the answer isn't going to be harvesting your own cells via a surgical extraction. The answer in this field is going to be who can productize an allogeneic off-the-shelf cell that can be produced to the high standards of a pharmaceutical and is one-size-fits-all. That's actually where we are at Celularity. So, Celularity is the company that pioneered the use of the leftovers from a full-term healthy pregnancy and isolating the cells from that organ to do all of this. Here's the cool thing Dave and you'll appreciate this.

Bob: The challenge early on in cellular medicine is, could you find a cell that could be delivered to a recipient without having to go through the exhaustive effort of matching the donor to the recipient the way we do for organs? Here's the thing. Nature did the work for us already. The placenta is nature's professional allograft which means it's designed to exist in an unrelated recipient without the need to match. Think about this. A mother contributes 50% of the DNA to the fetus she carries, yet for nine months she doesn't reject it. It doesn't reject her. Right?

Dave: Yep.

Bob: Think about surrogate pregnancy. The mother’s not even related to the fetus. She contributes no DNA. She's completely unmatched to the tissue type of the fetus, yet she carries it for nine months, doesn't reject it. It doesn't reject her. The underlying biology behind this is one of the most powerful tools we are incorporating in our entire therapeutic strategy. So, stem cells from the placenta are naturally allergenic and it means you don't have to harvest your own cells which by the way, this isn't any kind of a knock on you because you're one of the healthiest guys I know, but as we age, we damage our own stem cells in our fat tissue, in our bone marrow, etc. The stem cells that come from a newborn are pristine. They are in the best biological state that will ever be. So, stem cells from a placenta will always have qualitative advantages over cells recovered at some point in your life.

Dave: Oh yeah. I'm 45 and I used to weigh 300 lbs. and I had all sorts of autoimmune conditions. You said I've had some hard living especially in the first half of my life. I'm sure that that's reflected in my stem cells probably even in the number of DNA mutations I have and things like that. So, I'd rather get fresh stem cells and frankly, I've

had my bone marrow tapped now a couple times and having the kind of liposuction which isn't cosmetic but where they just pull fat out, it's about a coffee cups worth of fat. It's not a really fun procedure to be honest. What I got from that was definitely matched themselves but I got 45-year-old stem cells and I would have rather had 0-year-old stem cells.

Bob: That's right. Since you and I didn't have the benefit of storing our stem cells from birth, today our kids and kids have an opportunity to do that and that's going to be very, very important going forward, but the beauty of placental cells is that we can administer them to unmatched recipients safely and effectively. Not only do they do they create a state of tolerance in the recipient, but because they're younger and because they have biological properties of young cells, there are significant advantages.

Dave: Why do we have to go out and get placental cells from fresh placentas when we can grow a cell line in a lab? So, you could just get one placenta and grow it and make hundreds of millions of doses from that, right?

Bob: So, the beauty of the placenta is it is a robust source, economical highly scalable. It could be subjected to very rigorous criteria for inclusion and exclusion, but the reason that we don't want to take just one source and over expand it is the same reason why cells at 45 might not be qualitatively as good as they are early in life. There is a natural, for lack of a better word, exhaustion of the biological potential of cells as we continually call upon them to divide and expand. We've shown this in the laboratory. In fact, it's a basis upon which our manufacturing methodologies have been created. In order to preserve the highest quality of the cell, we limit the number of times we drive that cell to divide.

Dave: Okay. So, the idea is stem cells that have been replicated over and over and over may basically age in a petri dish or bioreactor.

Bob: That's a great way of looking at.

Dave: Now, are there any ethical concerns? There's been going back to the very early days of stem cells, people thought they came from abortions and things like that. I know that these don't. Can you walk me through the ethical and moral considerations that you went through with Celularity to figure out how do we get these placental cells?

Bob: Absolutely. In fact, that's that's one of the fundamental questions I asked myself back when I began the company. At a time when most of the work was being done around stem cells recovered from discarded embryos or abortus material, there was an enormous debate, there was an underlying tone of controversy which put a tremendous risk on the entire field. Now, at that time and I don't want to get into my personal religious or my personal morality, but I felt it was fundamentally flawed to rely upon discarded embryos and fetal material, because you could always create a very perverted incentive to go after that, but staring me in the face and I have to thank my oldest daughter, my oldest daughter who's 27 now.

Bob: She's a Princeton graduate and had spent time at Oxford in Georgetown and now is getting her MBA at Wharton, when she was in utero, she taught me that the placenta was basically nature stem cell factory. Since we throw that factory away at the end of every birth, why not just go harvest these? So, number one, it's abundantly available. To use our buddy Peter's great terminology, abundance is important here. That's number one.

Bob: Number two and this is really critically important, the fundamental choice for a parent to donate this material for these purposes is left completely up to them. So, we collect these placentas to isolate cells and biological materials under full informed consent, giving the family the option to choose whether or not to do this based upon their own personal altruistic interests. Now, there's an opportunity in the future to be able to reward donors of this material by providing them access to some of the materials for their own purposes, but I will tell you in 20 some odd years of doing this, it is a rarity that a family says, “No, I would rather you incinerate the placenta than use it for something meaningful.” There's a fundamental altruism that exists in the period around the birth of a healthy child that the world is a beneficiary of.

Dave: So you could basically help someone who has Alzheimer's or some sort of traumatic injury or something or you could just throw it away and that does make sense. Are you concerned that maybe cells have consciousness or anything like that? I mean I've heard some people just on social media and whatnot, on Instagram will ask questions like that. Are you worried you're putting some other cells in your body? What's your just overall thinking about this isn't your cells, are they going to stick around and be a part of you?

Bob: You know what? That's an interesting question. Look, every living cell contains its own biological software written into its DNA. So, the DNA from a donor placental cell is different than your DNA. When that that cell takes up residence in you, temporarily or permanently, that new code, that new biological software has to coexist with your biological software. Now, people don't realize that but that's a fundamental biological principle. I will argue to you today that chimerism, the ability of another genome to coexist in a different organism is one of the fundamental biological principles of mammalian biology. Think about this, right?

Bob: Any placental mammal that produces more than one offspring actually exchanges cells between offspring between one another. This microscopic chimerism, this multiple genomes in the same organism is not only tolerated but it probably provides certain benefits. So, let's think about this. You know this world very well. In agriculture, chimerism, putting grafting together tree branches in order to create higher virility and higher disease resistance is a common practice. Chimerism has a therapeutic advantage. I've actually had a principal called chimeric vigor which we are actually working to develop. Think about it this way. You know what hybrid vigor is?

Dave: Yep.

Bob: Hybrid vigor, when you have two distinct parental genomes that come together to create offspring. Those genes recombine and select in order to provide advantages to the offspring. Means your offspring should be better than you, healthier, etcetera,

etcetera. That hybrid vigor occurs between generations, but if I take stem cells that have a genome that have certain biological properties that are advantageous and put them in you, those traits will get upregulated and expressed if it provides you a survival advantage. Chimeric vigor can occur within a generation.

Dave: So, I want stem cells from Wolverine?

Bob: Exactly. Hey, listen buddy. The truth of the matter is we are embarking on an era where we can quality check stem cells. We can understand the underlying biological software and select traits that when conferred to a recipient improve the health of that recipient. That's work that we're working on today. So, yeah. There's going to come a point where you can maximize your health by expressing those biological traits that give you certain selective advantages against disease.

Dave: It may sound weird this idea that you can have other DNA inside you, but there are studies a lot of people don't know about them that show that every time a woman has sex with a man, she gets a little bit of DNA from the semen that permanently resides in her system.

Bob: Either permanently or transit. By the way, multiparous women, women who have multiple children will carry cells from every child in their body for their lifetime. So, pregnancy and carrying children creates what's called multiple mixed microscopic chimerism. It is very tolerated.

Dave: There are also mitochondria which is a big focus for my work on my last book Headstrong where you look at this different DNA source which is the mitochondrial DNA that programs the power source in your cells. When you get stem cells from a donor, are you going to get those mitochondria? Will they take up residence in your system? Will they talk to your mitochondria? Will they change your mitochondrial genome in addition to giving you new cells?

Bob: So, the mitochondria are resident in the cells administered to you remain resident to those cells. So, you do get the advantage of mitochondrial collaborism as well. If that provides certain biological advantages, that will naturally get upregulated and expressed.

Dave: There are questions around whether stem cells that get administered intravenously or injected somewhere, whether those cells go in secrete healing factors and then die or whether they actually become new tissues for you. What is your research on you?

Bob: So, good question. Most of the work today suggests that stem cells exert their biological properties by transiently affecting the secretome of the individual contributing synthesized products to the individual and then moving on, dying off and not being a permanent resident. Now, the truth the matter is we don't have tools today that allow us to measure microscopically single cell or small cell clusters in the body. It's very, very tough to do that. So, I bet that even in what we think is transient cell therapy, there's some residual cellular material, but it's not necessary to exert the biological effects. One

of the beauties of a placental cell therapy strategy is these product can be re-administered. I actually envision that our form of cell therapy will be delivered in a linear fashion serially to continually get the biologic response you want.

Dave: How often do you get stem cells?

Bob: So, you know what? We're working right now on developing a strategy to deploy these in a network of research clinics that will be abroad as well as in the United States. I've been working with some factors from stem cells which I've administered to myself. Placental exosomes for example and I'm excited about being one of the recipients of placental cells in our research network.

Dave: How often?

Bob: You know what? I actually believe that for the kinds of applications I'm interested in, extending the healthy human lifespan, you can administer these things safely on an annual basis or semiannual basis.

Dave: I do it every six months.

Bob: You know that actually to me, everything we've seen, that goes along with the pharmacokinetics if you will of cell therapy, so I think you're making the right choice.

Dave: The last big treatment that I did which was probably one of the biggest single treatments all at one time, I had very large numbers of cells and I had 10 vials of placental exosomes all at the same time which is as you know a very high dose.

Bob: Big dose, yeah.

Dave: That was only a couple weeks ago, but I'm already feeling pretty good. I was a little out of it for a day or two as you'd expect afterwards. I'm looking at how do we make this so 300 something million people in the US can get access to it. What does it cost now to do a baseline cellularity treatment and how far down do you see it going in 2 years, 5 years, 10 years? Is this a cell phone situation where they’re 20 grand now and they're a dollar 20 years from now?

Bob: Absolutely. There's no doubt that this is a technology that will be introduced at costs that will be most approachable by people with high amounts of discretionary income. Then it's going to wind up trickling down. Like any breakthrough technology, there's a segment of the population that subsidizes the democratization of the products, right? There's nothing wrong with that. People shouldn't think that this is a technology that's exclusive or elitist or what not. That’s not the objective here. The truth is that because of our what we've built at Celularity, these are going to be very affordable therapeutics.

Bob: What we need is we need to operate within the confines of the regulatory community, so we can get an unimpeachably data set showing intrinsic safety. Then once you have that, the clinical and regulatory and scientific world becomes more comfortable with

using these products in conventional applications sort of the common applications dealing with age-related frailty, human performance, injury repair, etc. Look, I envision a time in the next 10 to 15 years where cell therapy is no more expensive than any traditional way we deal with inflammatory disease or cancer and will be far more effective and far safer.

Dave: I absolutely love that answer. There's a lot of skepticism from people saying this is for rich people. Here's the deal. You go back, Craig Venter, a guy that we both know, he spent $100 million sequencing his own genome. I've had my entire genome sequenced four years ago for 1,500 bucks and it's around $300 to sequence your full genome now. This is in our lifetime, just in 20 years. So, it's not that far-fetched to say … look someone had to be the guinea pig and I'm happy to raise my hand. That's what I do. To say that the mission of doing this is to make it so that it affects all human beings and that there's no reason that anyone would want to keep this here, because frankly I'd rather spend $100 instead of $1,000 on keeping myself young, right? So would everyone, and I'd rather be able to do it for my parents and my fifth cousins I've never met as well as everyone listening to the show. So, you see that as inevitable, right?

Bob: I do, and I think it is a fundamental driver of every business in the space. Look, I'm very fortunate. One of my members of my board of directors, well my vice-chairman in fact is John Sculley, the former CEO of Apple. We talked about this. John is one of the most brilliant creative leaders I've ever known and he's been a tremendous mentor. He's helped me understand that a noble cause as he puts it, a noble cause like what they did at Apple. The cost of introducing that first breakthrough technology was enormous. The risks were completely borne by the developers and the companies who did it, but look what happened. It transformed the world by putting communications and intelligence systems in the hands of everybody. The natural course of events is that the overall cost per capita drops and drops and drops and drops and drops. Everybody's got an iPhone. This is not inaccessible. We want to do the exact same thing with cellular therapy.

Dave: What are the things that are making it stay expensive longer than it should?

Bob: Again, the process of going through regulatory approval. It's drug development, right? The cost of drug development. Because of the enormous burden of proof and evidence necessary to get the legal right to sell a product, it is what keeps these things expensive and takes time to get them out there. Where I think we want to have an impact is we want to work with regulatory leaders and clinical leaders so that there's a greater comfort level with the intrinsic safety of this therapeutic approach. Cell therapy is very different than biologics and small molecules because we know they have a very high safety profile.

Bob: Regardless of what people may think, because there's been some sensationalized report of somebody who went to a renegade clinic, a fringe clinic out there and got treated with stem cells and something bad happened, the truth of the matter is cellular therapy clinics are all over the place and you don't see disasters reported on a regular basis, because cell therapy is intrinsically safe, but it's our responsibility as players developing this to get the proof in the form of high integrity data so that our colleagues on the

regulatory side, our colleagues of the academic institutions, our scientific colleagues believe it, have confidence in it and eventually become advocates for this.

Dave: I was a strategic advisor to the first clinical grade stick-on take home heart monitoring back in the early 2000s and designed a lot of the data processing for it. That company had to leave the US in order to do its clinical trials. They went to Med City in India. They went to Singapore and they were able to do things to prove that it worked at a much lower cost before they could do it in the US. I'm seeing issues of national competitiveness where it's just so expensive and so slow to do things in the US that a lot of the most innovative things are happening in China. They're happening in in Thailand. They're happening in India. Medical tourism is to the point where it's cheaper to go do things south of the border for instance. Do you see this as a regulatory issue, as a political issue? What's the US going to look like 20 years from now if we keep restricting this?

Bob: So, it's all of the above. All right. Look, you know what? Without getting into a political discussion-

Dave: I don't want to go there. Yeah.

Bob: We don't want to go there, but in an environment where you understand that regulations, initially the thought process behind a regulated environment is to ensure safety and to protect consumers. When those systems turn into a major impediment to progress, the public loses. So, we're already seeing I think the potential long-term benefits of a deregulation philosophy that is it's encouraging companies to invest in R&D. I think in the last 18 months, the reinvestment into R&D by companies that have been unburdened by regulations, I mean it's profound. The same thing will impact healthcare and medicine. I mean look, when the mindset at an agency is safety above all else, people are going to die waiting for products to get approved, right?

Dave: Yeah.

Bob: So, when you think about it, if someone is comfortable allowing a line of people to die because the therapeutic is not approved, because they're so concerned that if it was approved one patient might die on the therapy, that to me is a little counterintuitive.

Dave: There's a word for that. It's called evil.

Bob: Listen, I don't disagree with you, but here's the point. The regulatory world could say, “You know what? We understand what the mandate is here. So, let's establish a fundamental threshold for a demonstration of adequate safety and then let's put the tools back in the hands of the practicing physicians.” Who by the way, I think it's a little offensive that in some cases panels and committees of lawyers and policy makers are dictating what a highly trained physician or surgeon can actually do. Why not put that back into their hands but insist that they elevate the integrity and the comprehensive nature of the data they collect in every patient.

Bob: Let me give you an example. The standard for getting a drug approved is a well control placebo controlled double blinded study. You need a few of those to get drugs approved. When you do that in the conventional system today, it ain't a replicate of the real-world experience with those products. When you put the products into the hands of physicians in real-world practice but just insist that the data be collected at high integrity and high fidelity, so you can actually on a regular basis continually update what we know, you can envision a day where literally every label for every therapeutic product changes dynamically on the basis of ever-increasing human experience. That's a system I think would be perfect. It would give everyone comfort in getting products available to patients earlier.

Dave: The Hippocratic oath says first do no harm. Is it time to upgrade the Hippocratic oath to say first balance risk and reward?

Bob: I think the best docs out there do that Dave.

Dave: They do.

Bob: I think that they say, “You know what? There is no free lunch here.” Everything has predictable and unforeseen risk. As long as you're capable of monitoring the effects of everything we do in the treatment of disease and as long as that information is made readily available and disseminated quickly, we minimize the long term distributed effect of a bad outcome, and we maximize the tools that we can use to treat patients.

Dave: What you're saying in essence is that every patient could be part of a broad experiment if we get the data so that we learn over time?

Bob: That's what healthcare used to be. Remember, you go back 50 years. How did a doctor make decisions about treating a patient? Based upon his experience using a treatment modality and he based upon 10 patients, 20 patients, 100 patients experience made decisions about treating the next patient, right?

Dave: Right.

Bob: Okay. We don't do that anymore. What happens is we have pigeon-holed physicians into treating patients on the prescribed methodology that's in a package insert.

Dave: From the 1970s.

Bob: The philosophy was from the 70s and it still carries forth. Think about this for a second. You think doctors ever read that? You know who reads … Have you ever seen a package insert for a pharmaceutical? It's enormous. You think doctors ever read that? Never. You know who reads it word by word?

Dave: Lawyers.

Bob: Lawyers. It is used for evidentiary purposes in litigation. That's what drives me crazy. Doctors need to be able to doctor and we disarm them when we limit what they do on the basis of regulatory systems that don't take full advantage of the ongoing dynamic experience of a product in a patient.

Dave: How would someone listening to the show go about finding one of those courageous doctors willing to in essence risk their medical license to do the right thing for a patient? Is there a selection criteria that you would go through to find someone like that?

Bob: It's very hard to do it because you know what, those are the guys who in order to stay within the confines of the regulatory environment, from the law and so on and so forth, they practice medicine the way medicine is designed to be practiced today, but you'll find guys who are willing … clinical investigators who go in and work with the newest breakthrough therapies and those are the guys who are trying to push the envelope. Listen, I think healthcare in our country is broken. I think that there's ways to improve it. One of the great ways to improve it is to properly utilize the information management tools and computational tools so that literally every patient on a therapy is contributing to a data set that is analyzed dynamically and feeds back into the underlying prescribing information so that literally every patient is like you say a participant in a grand experiment.

Dave: As a patient, I think it's equally offensive that at least in the US I'm not allowed to decide what therapy I want with or without a partnership with a physician. My body, my biology, my decision, it wasn't encoded in the Bill of Rights, but it seems like that's a basic human right. Is our own biological autonomy, a basic human right in your opinion?

Bob: That's a great and sort of provocative question. Look, I'm kind of a libertarian by nature, and the way I look at it, we live at a time where any patient, any patient's family has access to more information than I ever had access to when I was in the clinics 30 years ago. People need to have an opportunity and a right to at least contribute to the decision-making about how their disease is managed. Look, at the end of the day, the best patient is the most well-informed patient. We sometimes don't give people the opportunity to make those decisions, but look, there were changes at hand.

Bob: The right-to-try act, this bill that the president recently helped advance, I think that that's not a bad thing. I have had very sad circumstances in my own family where I know that there were highly experimental therapeutics out there that could have changed the natural history of a disease but for fear of getting in trouble, we never got to use those therapeutics. There are patients out there who are sitting, waiting and hoping that breakthroughs get approved but they have no control over that. I think that access to experimental therapeutics under the right circumstances in the right environment especially if it can contribute to the dataset is a good thing for everybody.

Dave: I couldn't agree more and it's sad right now that sometimes the knowledge of those isn't out there, but if you have terminal cancer, I know several people and you probably do too who are having insane results in early human trials or in animal trials or heck in Petri dishes, but if you've got six months left to live, you should be absolutely allowed to say, “You know what? I'm going to die anyway. I think I'm going to try because we'll learn

something as I maybe don't die or actually die." The fact that that's not legal right now, it fundamentally pisses me off.

Bob: It's disappointing that our global leadership seems to think that they're in a better position to dictate the end-of-life care for patients. What they're actually losing is they're losing an opportunity to contribute important information that could change the course of how we treat diseases. So, I'm with you. I mean look, I believe that there's a whole array of disorders where there's lots of experimental things out there and we could actually hasten the review process and potentially speed up the availability of these things if we let people be courageous participants in an ongoing research effort to advance the field. Like you say, there are cancers out there that are being treated with immunotherapy and other things. Give people access to it as long as that data is made available for the world to review.

Dave: When it comes to treating aging as a disease and I don't necessarily see it as a disease but it's definitely something that we can change. It seems like there's this huge universe of opportunities, and I believe that stem cells and related stem cell growth faction all that are a fundamental thing for it, but we're dealing with an environment where since aging isn't officially a disease, you're not even allowed to treat it necessarily. How do you navigate that path of saying, "Well, we're not really treating a sickness. We're just making you better." when that isn't a medical claim, what's your thought process look like and how do you how do you speak about that both to regulators and to people?

Bob: You know Dave, it's a very, very tough place to play. Many of us are fearful that our enthusiasm about moving the field will be interpreted or perceived as an attempt to circumvent the law which clearly it's not. As a scientist, all I care about is getting to the truth as fast as possible. The reality is we have an opportunity to partner with the scientific, clinical and regulatory community to do things that don't get in the way of people's choices. I think that there's going to come a time where some charismatic leader is going to say, "No harm no foul if someone with a terminal disease winds up being a participant in the study of a breakthrough therapeutic." Whether or not it impacts their disease, as long as the information can be utilized to make decisions going forward in the development of those products.

Bob: You know what? Here's the crazy thing. You ask the general public an FDA approved drug is going to work, right? The truth of the matter is that the vast majority of approved drugs actually don't work in the patients they're prescribed in. Look at cancer drugs. The typical cancer drug works in less than a third, maybe a quarter of patients they actually get prescribed for. It doesn't mean that they're not approvable. What it means is that there is such biological diversity and in my mind, as long as you equip the clinical community with the broadest set of tools and allow them to make decisions on what works and doesn't work in a more dynamic basis rather than prescribed in a defensive way, right? I mean in cancer, doctors follow protocols because as long as you follow the protocol, you can't get blamed if there's a bad outcome, right?

Dave: Yeah.

Bob: So, again, I argue that much of what we're doing in getting agents approved under prescribing information doesn't necessarily help the patients, but it does serve as a basis for the legal community to try and find culpability when an outcome that's not expected or unwanted occurs. I don't know if that's good for the public.

Dave: It doesn't seem like it is, not even a little bit. So, I'm excited for the world that you're talking about there where a leader comes forth and says, “We're going to allow experimentation.” You said that that-

Bob: Again, the connotation of the word experimentation always appears to be exploitive. The truth is we have to change-

Dave: Self experimentation.

Bob: Right? Yeah. The truth of the matter is that people need an opportunity to test what works for them. No product works the same in two different individuals just like no medications.

Dave: Even though food works the same in different individuals, right?

Bob: So, listen, I think we're getting to a point where we're going to see an increase in the receptivity to do these sorts of things. I just hope it happens fast.

Dave: It will and the second step of that is that life itself right now is a terminal condition. That means once we open the door for people to self-experiment in partnership with technology and with physicians, at a very soon point after that, we'll say, “Well, wait a minute, I know it's going to happen 100 in my case, at least 180 years out, I think I'd like to effect that now and then self-experimenting can just be built into our ability to be human being.” There's a downside or a risk to this that I want to pick your brain on. We've talked a little bit about cancer. Any time you increase regenerative capacity and growth in tissues what you want as you age, you also could be running the risk of increasing the risk of cancer. Are you concerned as we push the limits of aging or healthy aging and as we cause cells to get younger that it might change the risks of cancer and if so, what do you do about it?

Bob: That was a very central early concern about the use of stem cells in in medicine that, “Hey, is it stem cell potentially an ignition source for cancer?” In practice, that hasn't been the case. There has been an enormous number of recipients of some form of stem cell therapy and there has not been an association between those products and an increased risk of cancer. The data is still being generated but I believe that healthy stem cells, stem cells from the right source do not increase the risk of cancer. By the way, in some cases, stem cell therapy because it helps support a healthy immune system could in fact reduce the risk of cancer.

Dave: I've had my blood taken out and had my natural killer cells cultured and had about two billion of them reintroduced all at once which is something that they do for cancer. I don't have cancer. I just want a really young immune system. So, there are some really

cool things you can do if you're concerned about that. I look at the data you shared in your talk I hear at the X Prize event and you said something like 58% of people past 90 get Alzheimer's or cognitive decline or dementia, 58%. So, if you have a 10% increase in cancer risk and a 58% reduction in Alzheimer's risk, I don't know, I'd sign up for that.

Bob: I think you're right and I think also that if we actually uncover that cell therapy speeds up the development of a malignancy, that's the kind of information that forewarned will actually increase our vigilance. You could have the trade off of you benefit one disease, change the dynamic or risk for another but now at least you know what to look for. Remember, cancer when identified early is curable, fundamentally curable. I mean stage zero cancer has one of the highest overall cure rates because you can excise in one way or another the core of that malignancy and eradicate the problem, but I mean look, this is a big team effort that's required between all of the constituents here, from the patients to the basic scientists. I just want to make certain that we don't hamstring what might be one of the greatest therapeutic breakthroughs in history because of irrational fear and underlying political agendas which confuse and confound the issue.

Dave: Bob, how long are you going to live?

Bob: You know what? Listen, I've got I got three kids who are the absolute reason for getting up every day. I hope that I'm around to see their children and maybe even their children's children. I think that with what we know today, someone like me could easily live to 90 to 100. I think that if some of the tools we bring to bear today get to the point where there every day available, we could push that even beyond, but I do know that my kids are guaranteed to live to 100. I believe that their kids have the potential to live to 120 to 150. If our good Ray Kurzweil is right and we reach that longevity escape velocity, we may actually be able to maintain a form of life well, well beyond even 150.

Dave: I think that it may have been faster than that. I mean we're here with Peter Diamandis, the king of exponential technology and abundance and all that. I look at my own experience with the internet. I hope to design the first provision on demand thing which is a precursor to what we do with Amazon Cloud Services and all that. You look at what happened in the course of our lifetime. You've got 30 years of clinical practice in starting companies. You've seen how fast things are changing. If we change 10 times faster over the next 30 years, don't you think you're thinking small?

Bob: I'm being conservative because you're mostly held accountable for the bad predictions rather than the good ones, right? Look, I'm highly optimistic and like you say, you know what the great thing about this kind of an environment for us Dave is we've gotten to know each other and build friendships and a fraternity here where we're with the smartest, most creative, most innovative, most enthusiastic people on the planet. So, in this environment, I agree with you. I think we can step out of our comfort zone and say, “You know what? 150 is an easy achievable lifespan.” So, I'm with you my friend.

Dave: Well let's race and I'm willing to die trying. It's totally okay.

Bob: Me too. We'll do it together.

Dave: We will. I have one more question for you. Someone comes to you tomorrow and says, “Bob, I want to perform better at everything I do as a human being. Tell me the three most important piece of advice you have based on everything you know.” What would you recommend?

Bob: First and foremost, I am convinced that maintaining the largest healthy lean muscle mass is central to overall human performance; mobility, cognition and aesthetics. So, that's number one and there's lots of ways you can do that outside of the therapeutic realm. We need to do what nature intended which is load our muscle and to permit our muscle to maintain its highest mass and health. The second thing is I want to avail myself of all of the breakthroughs in cellular medicine, because I do believe that is one of the easiest tool sets we have out there. Then the third thing is there is a whole sphere on the intellectual and sort of emotional and spiritual side of things that's a contributor here that we have yet to fully understand. We saw some great talks today on how complex the brain is and how the interplay between the brain, immune system and so on is ultimately programmable, right?

Dave: It is.

Bob: I want to stay in touch and tune into that because that's going to be a contributor as well.

Dave: It's one of the reasons I started a neuroscience facility called 40 Years of Zen and because I wanted neuroscientists to help me work on that, because we've shown as Candace Pert’s work, the woman who discovered the first opiate receptor, that your immune system has its own memory and that's got to be hackable.

Bob: That's right.

Dave: Right. Well, I love those answers. Bob, thank you and thank you for your work with Celularity. You're pushing the boundaries of what we can do to regrow ourselves and become younger. I'm grateful that there are people like you doing the work that's required, the deep science work in order for us to all get access to stem cells and growth factors and things like that at an affordable level. So, thank you.

Bob: Dave, thank you. As one of my heroes, thanks for including me today.

Dave: If you liked today's episode, you know what to do. Go out there and get some stem cells, okay? Maybe you just put that on your bucket list because the cost is coming down, but if you are dealing with chronic pain, you're dealing with injuries that haven't healed, your chronic conditions as you're aging or even when you're young, this is something that should be in your list of menu options. It's really worth doing. While you're at it, you certainly can go to Celularity’s website. That's C-E-L-L-U-L-

Bob: Yeah, let me get that because it's … By the way, Celularity is intentionally misspelled as a spin-off of cell gene. It’s one L. So, it’s C-E-L-U-L-A-R-I-T-Y.com.

Dave: All right. So, there's a bunch of stuff you can learn there. While you're at it, if you haven't pre-ordered Game Changers, my new book, check it out on Amazon or your favorite bookseller. Just search for Game Changers Asprey and I have gone to the trouble of summarizing and in a statistically valid way, looking at all the answers to that question that you just heard to figure out what hundreds of the world's top performers believe matters most, so that when you have that extra energy that comes from turning on your mitochondria you know what to do with it to get the most results in your life. It's Game Changers. Thank you.