

Dave: Hey guys you know I love Dollar Shave Club. I've been using the razors for quite a while now and the shave is fantastic. What you probably don't know is that they've got a bunch of other amazing products too. For instance they have a new skin repair serum that's got a ton of hyaluronic acid in it which is something you really, really want to use to have healthy collagen in your skin.

Once you join the club, you'll see they've got a bunch of other great stuff for you and it's all affordable. Right now is your chance to see for yourself why so many of us love Dollar Shave Club. If you're not a member yet and you've never joined, now is the time. You get your first month of razors for free. Just pay shipping. After that, it's only a few bucks a month. Join today. Head on over to dollarshaveclub.com/bulletproof. That's dollarshaveclub.com/bulletproof.

Female: BulletProof Radio a station of high performance.

Dave: You're listening to BulletProof Radio with Dave Asprey. Today's cool fact of the day is that believe it or not many experience Alzheimer's disease as often as women. It turns out though there are more women with Alzheimer's disease and other forms of dementia than men. That's just because there are women on the planet because they live longer than men.

Basically us guys we die sooner and that's why there are women with Alzheimer's even though we get it just as much as they do. It turns out too that men get a higher occurrence of vascular dementia which is where you're having problems with blood delivery to the brain which is going to cause you to have the cognitive dysfunction that often comes with aging and a different study found that brain atrophy is more common in men than women. Not only do women live longer, they seem to have brains that don't shrink as much as men's. Either way it seems to be a good idea to take really good care of your brain and take good care of the rest of your body so that you can like me live to 180 or beyond. At least that's the goal. As I'd like to say I'll die trying.

Before we get into the show here's a big announcement for you today. Actually it's a small announcement like 3 ounces small. After receiving literally thousands of emails from people requesting something more portable than our 16 and 32 ounce bottles of brain octane BulletProof is finally rolling a 3 ounce travel sized bottle. They're portable. They're spill proof. They're TSA friendly and they come in just under the 3.4 ounce liquid they make for airplanes. That's really important for someone like me who travels over 100 days out of the year. In order to celebrate the kickoff of the new 3 ounce bottle of brain octane, I'm offering you a chance to try out the new 3 ounce bottle for free.

All you have to do is pick up the cost of shipping. Just text the word bpradio to the number 38470 on your mobile phone and then respond with your email address to get a special coupon code for a 3 ounce bottle of brain octane free when you pay standard shipping anywhere in the US. Again just text the word bpradio to the number 38470. That's number 38470 and reply when you get a text back asking for your email address so I can email you the code for a free bottle. I actually started carrying 6 of these bottles in my quart size zip lock and its still carry on legal.

If you haven't checked out the BulletProof upgraded aging formula in a while, this is one of those profoundly effective things that is on the website that you might not have heard about. It helps your brain function better in 4 different pathways that are tied with aging including mimicking the effect of caloric restriction, helping you to have healthy blood sugar levels as well as helping to protect your neurons from exposure to excessive levels of glutamate. Strange little antioxidant compound that's a part of the Krebs cycle that you can take. It's very meaningful. I take it every day as part of my anti-aging stacks. If you haven't heard about this it's on bulletproof.com. It's called BulletProof upgraded aging formula.

Before we jump into the show which as you might have guessed has something to do with neurodegeneration and maybe even talking about Alzheimer's and stuff like that. One of the first problems I worked on solving after I developed the BulletProof diet and shed all of my unwanted fat was I had to shop for new clothing. Everything from pants and T-shirts to shorts and dress suits. Buying a suit was always painful for me. Finding something that's comfortable, affordable and built with quality materials was a painful experience.

Then someone introduced me to Indochino. Indochino is one of the largest made to measure men's wear brands. They're making it easy for men to get a great fitting, high quality suit and shirt at an incredible price. Here's how it works. Visit indochino.com or drop by any of their 9 North American showrooms. Pick from hundreds of fabrics and patterns. Choose your customizations from lapels to pleats to jacket linings and more. Submit your body measurements. Kick back, relax and get ready to step into the best most stylish suit you've ever worn in just 4 weeks.

This week BulletProof listeners can get any premium Indochino suit for just \$389 at indochino.com when entering code BulletProof at check out. That's 50% off the regular price from made to measure premium suit plus shipping is free. That's indochino.com promo code BulletProof for any premium suit for just \$389 with free shipping. You'll never have to worry about badly fitting suits or expensive trips to the tailor again. Get ready to look like a million bucks.

I'd love it if you want to go to iTunes and just said "Hey give us a 5 star feedback." BulletProof Radio is not just me there's a team at BulletProof. We pull together these episodes for you. We film them. We record them. We edit them and we do it with the intent of helping you know some stuff that you don't know. The side effect is I get to ask people questions I would ask them over drinks anyway although in this case it would have been a high resveratrol nonalcoholic drink if it was my decision or at least high polyphenol.

Today's guest is Dr. Michael Fossel. He's a highly respected physician, author, lecturer, neurobiologist and he's pretty famous I would say for his work around telomerase therapy as a possible treatment for we'll just say for aging or as I call it cellular [senescence 00:06:13]. He teaches biology of aging at Michigan University, has written a bunch of books on ethics and aging and he's working on bringing telomerase therapy to

trials.

If you don't know about telomeres or telomerase there's a theory that your cells only have so many divisions before they run out of telomeres and telomerase could be the secret to that. The Wall Street journal called Dr. Michael Fossel's latest book the Telomerase Revolution one of the best science books of the year. This is a book that if you're a serious biohacker you absolutely should read. In the meantime just to convince yourself that you should read it, why don't you hear from the man himself Dr. Michael Fossel. Welcome to the show Dr. Fossel.

Michael: Hi dude thank you. Let's keep doing 180 years too please.

Dave: It's a deal. When people call you Dr. Fossel do they automatically just think that you're either really old into aging or that you work with dinosaur bones? Which is it?

Michael: No, I always wished I'd been a paleontologist. It would have been a great thing to direct a museum of paleontology like a fossil. I had to tell you though when I was kid there was five of us in the family. My mother was a single mom and one Sunday morning was quiet around the house. Now if you have five boys and it's quiet, there's a problem. She came down to the bottom of the driveway and discovered us putting up a big sign that said 50 cents come and see oldest living fossil. She made us take it down.

Dave: For the record for people who might be searching for you on amazon right now it's F-O-S-S-E-L not F-O-S-S-I-L. That's awesome. The things kids do, right?

Michael: Adults too actually. That's [inaudible 00:07:55] for that.

Dave: You said something amazing at the beginning of your book when I was reading it that I thought was actually worth repeating so that you could tell me why you chose this. In the book dedication you wrote to those with minds open to logic and eyes open to data may others be as open to you as you are to the world around you. To those who aging and suffering hear others tell you nothing can be done, they're wrong. What made you put that in your dedication?

Michael: A couple of things. There are really two separate points three. One is I discovered that a lot of people have very closed minds. Sometimes they have the right idea but they still are not thinking accurately. You see this in politics. You see it in science. You see it in a lot of things. With regard to aging where I see it as that people often don't focus on logic or even better on the data, they focus on their own prejudices about how things work. As usual nature and biology and medicine is usually much more complex than people realize but they sometimes just make a decision about what can and can't be done and that's particularly true of aging.

We sometimes divide diseases into a couple of categories. Those things that we think we've gotten some place on for example infectious disease. Diseases that we can't do anything about but we think we're about to. For example some genetic diseases. Then there's still this category that people have in our heads of disease they don't think we

can do anything about and that is almost always age related diseases whether its Alzheimer's or otherwise.

I'll give you an example of this. Last year the World Health Organization, Margaret Chan was the director who put out the annual report this month last year that said it was time we give up the curative model. If you give up the curative model you're certainly not going to cure it. If we've given up the curative model for polio in 1950 we'd still all be on iron lungs and having leg braces. I think that when somebody says you can't cure age related diseases, what they mean is they don't know how you could do it but I think it takes a little more imagination, a lot more logic and some careful thinking about all this.

Dave: That's a pretty bold statement to say just flat out cure it. It reminds me of another time in my career. I'm a computer science guy by training. I worked in Silicon Valley for a long time and when I was getting my degree in computer information systems they taught us really carefully "Don't use the term artificial intelligence because it'll never come true. It's just too big of a thing. Use these other words like decision support systems which is what my concentration was in my studies."

Decision support systems are a part of artificial intelligence but we would never call it that. It's happening now with aging where they're saying, "Well don't say you'll cure aging. Oh my goodness that could never happen." If you look at the state of artificial intelligence now it's actually happening and we have self-driving cars and machines that write their own code. They actually did it. It just took them 25 years longer than they thought. Is the same thing happening with aging right now?

Michael: I think so. Somebody pointed out the quote the other day. A [Lord Kelvin 00:11:04] back about almost 200 years said that we would never have heavier than air aircraft. It felt that way because if it's heavier, it falls down but you're neglecting the Bernoulli principle. You're neglecting aerodynamics. From his standpoint it made sense that there never could be a heavier than air aircraft but the Wright Brothers less than 50 years later proved him wrong. I think that's where we are with regard to aging too. If what you think about is a sort of a small molecular approach. Can we cure this with just a few chemicals? The answer is no but if you think more carefully about how [inaudible 00:11:38] works I think the answer is yes.

It reminds me about that general point about aging as a disease. There are a lot of biologist who would say that aging is not a disease. To me this is simply a matter of semantics. What [inaudible 00:11:50] is that the very same people who tell me that aging is not a disease are dyeing their hair, getting Botox. It just goes on and on. They act like it's a disease but they're telling you it's not. I don't really care whether it is or isn't. The point is to see us improve people's lives and I think we can do it.

Dave: There's so many different theories of aging. Aubrey de Grey is a friend who's infamous for his ... I just blanked on it if it's five or seven. It's certainly an odd number. Anyway, main theories of aging and telomeres are definitely something to pay attention to in that there's other big theories of aging. Can you walk me through some of them? I know you write about this in your book, but what are some of the historical aging theories

that stand out most to you as being interesting?

Michael: The problem with most of them is that there are some aging theories that aren't theories because you can't test them. My aging theory is that it's all caused by little green demons and if I can't prove that then that's not a theory. It's just an interesting conversation over that glass of resveratrol and alcohol that you're talking about earlier. That's fine but that's not science and it's not medicine. There were a lot of theories that are essentially not testable but there are a lot of theories that fly in the face of what we know about things. I'll give an example of this.

One theory would be that all aging is just a matter of entropy and things fall apart over time. That's fine except that if you think about it you realize that the cells at the tip of my nose here are now 65 years old and they came originally from a cell from my mother who was 40 something when she had me. It came from her grandmother who came from her mother. In fact in a very real biological sense the cells on the tip of my nose are now 3 1/2 billion years old. Why did that cell not age and yet in the matter of six decades I screw up? Why the difference?

The same thing will be said for the greater mitochondrial theories of aging. It is true the mitochondria play a big role on aging but if your theory of aging is that mitochondria just fall apart over time then you have to explain why the mitochondria in my body came from my mother that came from her mother and those mitochondria go roughly a billion and a half years. What you have to say is not that mitochondria cause aging but that mitochondria didn't age for a billion and a half years and then in a matter of decades they age. Why?

What you find is a number of these theories they fly in the face of common observations. If what I'm doing is looking just at dogs and cats and horses and pigs and people, animals for example birds or fish, they all seem to age and yet if you go back to the cell line and expand your view biologically, you discover that there are exceptions. Things that don't age, things that do age common things do but not everything does. It reminds me of physics.

Classical physics works fine until you go down to the quantum level or up to the level of relativity and then you find you need to expand your view. The same is true of aging. If what you're doing is just looking at dogs and cats and people, you're right. If you expand it and look back the germ cell line and expand your view back through time, you realize that your explanation of aging doesn't hold on.

Here's another one. There's that old explanation of how the universe is created. It sits on top of a turtle. What does that sit on the turtle it sits on a turtle? It's turtles all over the town. If what I want to do is explain aging in terms for example with just endocrine changes, then the question is, "What endocrine gland sets the pattern?" Name it. Then, what times it would end that endocrine gland? Is it turtles all the way down? Why is it that some animals don't age as fast as others and certain organisms don't age? Is that all just endocrine and non-endocrine? The answer is it doesn't actually [inaudible 00:15:43]. When you try to explain there's turtles all the way down, you're missing

something.

The disadvantage of looking at things in terms of telomerase and cell senescence is that those people actually don't understand. I understand its complex. The advantage is that it actually is consistent with all the data and furthermore when we intervene it works is that we can reset aging in human cells, human tissues and as far as we can tell somewhat in people.

Dave: I've just finished writing a book about mitochondria and there's pretty good evidence. We can measure mitochondrial efficiency. There's pretty good evidence that 48% of us before age 40 have early onset mitochondrial deficiencies. In other words it's like the engine in your car it blows a gasket. It still runs. It just doesn't run quite as well as it did. The efficiency of energy production goes down over time and over 40 almost everyone is making less energy per rotation of the Krebs cycle because they're leaking electron somewhere.

I know that you can hack that and when you do you get immediate performance improvements and many of the neurological diseases of aging go away. It doesn't mean that it makes you live forever. It doesn't mean it cures aging but it seems like it's an important variable. Do you support that view or is it even less important in your view of things?

Michael: It is important but you're still not looking back far enough fundamentally and asking yourself why that happens. If we look more example for example at mitochondrial function particular with the Krebs cycle. What you find is that all of the enzymes that are responsible for the aerobic portions of the Krebs cycle who are not from mitochondria but from the nucleus. What you've seen is that if you look at the rate at which those are turned over, because it's a dynamic process, you don't just get an enzyme that sits there for 100 years.

No, it's continually coming apart and being replaced by new enzymes. There's a turnover process. What you find is that if you look at the enzymes that are supplied from the [inaudible 00:17:45] they begin to be downregulated as the telomere shortens. What you're finding is that the turnover rate in your mitochondria goes down.

I'm giving you an example. Let's say that any of your listeners work in a great big building and they have a maintenance budget of \$100,000 a year to clean the floors, clean the windows, do the carpets. They decide to save money and they cut it back to \$10,000. You get the same cleaners that just don't come in as often. They're very efficient they just only now they come in every two weeks rather than every day. Likewise the soap is the same and the vacuums are the same. The amount of dirt is the same but the whole building begins to look dingy it's all because you turned down the maintenance budget.

That's what's happening with mitochondria. You're turning down the rate of which you're turning things over. You're not cleaning things up as fast. The outcome is as you've already said if I look at a whole mole of sugar I put in and I ask how many ATP I

get for that, the answer goes down. If I ask how many reactive oxygen species [inaudible 00:18:44], the answer goes up. It's worse than that because the same thing is true of the [bilipid 00:18:48] membrane that holds the mitochondria together. What it does is it sequesters reactive oxygen species.

Not only you're making more but now the lipid membranes aren't being turned over as fast. Again, that's not just a static membrane. They're continually turned over so they get leakier. Not only they leaking but then once they get out there, you trap reactive oxygen species, [the peroxide 00:19:10] dismutase, catalase. You have a number of compounds but the ones that you create in your cells for example SOD and catalase turn down also.

The efficiency of trapping those escaped mitochondria go down and then your efficiency of repairing the enzymes you destroyed, the protein damage because of reactive oxygen species go down. You make more reactive oxygen species. You leak in your membranes. You don't trap them and you don't repair the damage. All of those ultimately go back to changes within the nucleus. The mitochondria plays a huge role but it's because of what's happening in the nucleus that the mitochondria fails.

Dave: That is a part of the equation but it's also because of what happens in the environment around us. We have epigenetics. We have what happens even in the nucleus of a cell is controlled by the environment around you. In other words ...

Michael: Exactly.

Dave: If you don't get like the circadian component, the idea that your mitochondria are derived from bacteria, they had a night and they had a daytime. You had bright lights at night, you get mitochondrial dysfunction. You'll probably also get endocrine dysfunction higher up in your brain and all that. It seems like there's this really complex interaction between our genetics and our nuclear DNA and with the environment. You're saying that that also then influences telomeres and influences your mitochondria which is why aging is such an ugly problem to hack, right?

Michael: Oh yes. I would never say that telomeres cause aging. I'm not sure that the word cause makes a lot of sense.

Dave: Fair point.

Michael: Before you interne. It's a practical issue for me. Let me put that whole epigenetic issue in context because you're absolutely right. First of all, if I look at all of your genes and I ask, how many genes actually express proteins that actually go and do something yourself? The answer is about 1 1/2 %. Then I look at the rest of your genes and I ask myself, what do they do? We know that at least 30% to 40% of your genes actually are regulatory. What that tells you is that approximately 30 times as many genes are involved in regulating genes as they are involved in actually making important proteins.

The genes that actually do the work, the protein producing genes, are very tiny

component and everything else controls them. That's why the difference between my hair cells and my toe cells is not genetic. It's regulatory. It's what controlled, what's expressed. The same thing is true with regard to aging. The difference between [TA-6 and TA-65 00:21:34] is not [inaudible 00:21:37] it's all epigenetic. It's all just the way they're expressed. Now what you've done is beg an interesting question which is well that's nice, but what controls the epigenetic change? You've already alluded to telomere shortening and that's fine. Why does that happen? The answer is the rate of telomere shortening depends on what I want you do to.

Example, if I'm a professional basketball player and I jump up and down on my knees all day, I'm killing all chondrocytes. They're being replaced by the other chondrocytes there and those cells of your body. In short, they're aging faster which is why old basketball players have worse osteoarthritis than old yoga people. The same is true with everything else.

Do you smoke? Do you have night shifts? Do you go out in the sun and get sunburn? Are you exposed to radiation? It just goes on and on. That brings us back to the interesting question about what causes aging. The answer is depends what you mean by cause. It's like, what causes this podcast? What are you asking? What level you want to get an answer here? That's why I think from my perspective when it comes to aging, the question isn't so much what causes it is where you can intervene.

Dave: How do you like it?

Michael: Causation is like little kids asking why. It's a slippery concept and it's usually intellectually lazy. What you need to do is specify what you mean and what can we do about it.

Dave: What can we do about aging men? In fact, I want to ask you that question but I realize some listeners may not really know what telomeres are and I gave a very back of the envelope perspective but you have been studying them for decades. Can you define telomeres and telomerase so people have a really good picture of it in their head? Then let's talk about what you can do about it.

Michael: Usual analogy and it's not a good one in some ways. Usual analogy is that little plastic sleeve at the end of your shoelace if anybody have shoelaces these days called the aglet. There's even a song about that from Phineas and Ferb I think. In any case they are the last several thousand base pairs at the end of each chromosome. What's interesting is that as cells divide they shorten but what's important is as they shorten they effect a pattern of gene expression throughout the rest of these chromosomes.

They act in some ways like a clock. By the way, they don't unravel. I've heard that before various times in various places on some medical TV shows. They don't unravel. They just shorten. It also [doesn't matter 00:23:56] what the length is, the question is what's the change in length. That's why some mice have telomeres that are 10 times longer than ours typically and yet they have mice spans that are typically 20 times shorter than ours. It's not the length, it's the change in length and what that does to the pattern of gene

expression back to which you said with epigenetics.

Epigenetics is everything. Sometimes people worry about genes that are involved in 20th century medicine. Very bright people but that's 20th century medicine. Twenty-first century medicine is epigenetics. It's much more complex than we realize, much more important.

What's going on is that as the telomere is shorten, it changes the pattern of gene expression. It changes the tune that the orchestra plays and the result is that we begin to fail and get diseases. The question is, what happens if you use to reset it? That was first done 17 years ago. We can do that in human cells and when you do that, you reset the entire pattern of gene expression and the cells act like young cells. It was first done in human tissue 16 years ago, works fine. The question is, can we do it to people and will it have the clinical results that we think it will? The answer is we're about to find that out.

Dave: What do you predict will happen in those studies?

Michael: What I predict is a couple of things. One is the major worry which I will [pass by 00:25:13] now unless you want to get into it has been cancer. The answer is no actually telomerase appears to be more protective against [inaudible 00:25:20] causing. There are some interesting little exceptions as ever and they're complex. The very general way you're less likely to get cancer if you have a long telomere than if you have a short telomere because it upregulates [inaudible 00:25:32] longer telomeres upregulate DNA repair.

The other thing is, what happens to cells and tissues? The answer is they act like more young cells and young tissues. As I said those were first done in human tissue 16 years ago. What you find is you can for example take old human skin cells and grow young human skin. Don't tell me you can't reverse thing that was done at least 16 years ago. The question is, can we do with you? That's a different question.

We have a number of ways to do that. I can think of about four or five right of the bat some of which probably are technically very hard to do. There are a number of targets we can use. We're going to after Alzheimer's disease for a number of strategic reasons. That's our first target.

Dave: Why Alzheimer's disease?

Michael: let me put it this way. Say I have an experimental gene therapy and I tell you I can get rid of some wrinkles with it but we're not sure of the side effects. It's an experimental gene therapy. My response would be, "That's nice [inaudible 00:26:35] in a couple of years." I don't want to take the risk.

Now say I say to you also you got osteoarthritis in both knees and we could give you a new replacement. We can put you on Motrin. We can tell you good luck. Would you like to try an experimental gene therapy? Again, practically speaking my personal answer

would be, "Let me know how it works for a year or two and talk to me again but not today." There are alternatives. You can always get a knee replacement. I'm not recommending it personally but it's painful. It's got risks on its own and yet what else could you do.

When it comes to Alzheimer's the answer is there's no alternative. Alzheimer's is 100% fatal. The average time to death is eight years. People vary a lot. The only way if you don't have Alzheimer's is something else kills you first like pneumonia. There are literally no drugs that really affect Alzheimer's. There are some 5 drugs in the global market and none of them has ever been shown to have any effect in the course of the disease. There are a number of drugs in FDA trials right now and although they've been shown to have some effect on things like beta amyloid or mitochondrial function, none of them have ever been shown to affect the course of the disease.

Dave: Nutritional ketosis seems to affect the course of it pretty dramatically like Dominic D'Agostino has been able to show a couple of times that it seems like we made some progress there.

Michael: I don't think so. I just say I disagree.

Dave: That will be a fascinating conversation. We probably won't cover it in this interview but we may have to have you back on. That's cool. I respect you're willing to just put it out there the way it is. I didn't expect that you would experiment ...

Michael: Let me give you a different thing though. Let me just say that I think that we can cure Alzheimer's disease. Very few people would say that. For example, if I go to the Alzheimer's association website, you'll find one of their webpages says that their goal is to help people live to live with Alzheimer's.

Dave: Terrible.

Michael: Not me. I'd like to let people learn to live without Alzheimer's.

Dave: Damn straight.

Michael: It's doable. I think it's doable in two years.

Dave: Wow! Within two years because of the therapies you're working on?

Michael: Yes.

Dave: Wow! God speed to you on those because that's a game changer. Part of my goal at BulletProof is to meaningfully reduce the incidence of Alzheimer's through basically epigenetics. There's things you can do that set yourself up to get Alzheimer's you just do them 20 years before you get it so you can either delay or prevent it just by making lifestyle changes much earlier.

Michael: I agree. In fact, let me come back with a couple of historical precedence. This one is not exactly parallel but it's pretty close and that is polio. If I go back to 1950 and I say, "What are you going to do to keep your kids from getting polio?" People would talk about avoiding public pools. Avoiding large social gatherings. There was a book that was a bestseller in 1952 in the United States that was called Diet conquers Polio. There was a reason for that. I don't believe that diet conquers polio but I am pretty convinced that probably if you have a terrible diet and therefore a weakened immune system, you probably have better chance of getting polio.

Given a choice between a good diet and a polio vaccine to prevent polio, I'd go with the polio vaccine perfectly in favor of diet. If I really want to prevent it, I'll take the vaccine. However, if I was in 1952 I'd be focusing on diet. I'd be focusing on public pools. I'd be focusing on a lot of things. That's what we are with regard to Alzheimer's disease.

I know someone who I diagnosed with ALS. He went off to a snake bite clinic and he asked me did I think it would work. My answer was no I don't think so but were I in your shoes, I'd go to the snake bit clinic. There's so many things like that with regard to Alzheimer's disease. There is I think commercially right now available nothing that will cure Alzheimer's disease but I would be trying everything I can think of whether it was exercise, meditation, diet, you name it. Not because I think it will absolutely work but because what have you got.

Dave: Biohacking is this concept that I've popularized and the gist of it is you change the environment around you and inside you so that you have more control of your own biology. I feel like I had nothing left to lose in my mid 20's because I was 300 pounds. My brain wasn't working. I had massive cognitive dysfunction, arthritis in my knees since I was 14. I feel like I'm old. I feel like I'm dying and I'm 29. They told me I'm going to have a stroke and a heart attack. I got nothing to lose. I'm going to hack this.

I spent half a million dollars in 15 years and became known in anti-aging and things like that. For the exact same mindset you have there, you're like, "I have Alzheimer's. I have X amount of years. I might as well try everything because if I don't try everything I know what's going to happen." I felt that way as a young man which informed a lot of what I do today. That mindset is something that I think a lot of people maybe don't have even when they have terminal cancer, may have Alzheimer's, may have ALS. Are you seeing a change in patients or in the population where people are more willing to experiment because they realizes they're facing the end?

Michael: Yes. I think that in some sense it's always been true but there have been some remarkable changes in the stress in people's lives. The other day I was looking at old Cary Grant movie from 1940 I think it was and we've all seen old movies like this where the banker for example, the genetic banker with gray hair. Everybody is looking up to this banker and he runs the bank. He's a remarkable person. You go online to find out how old he actually is and you discover that he is 45 years old and you would swear he's 85.

We've all seen people in old movies who look older than you and I would have thought

they look these days. Some people don't think I look 65 but the point is they live different lifestyles. The stress is involved in those lives. Those days were different. Almost all are [inaudible 00:32:28] smokers. They were probably heavier drinkers than most of us are right now. They had different lifestyle. We all have stress but the stress that's involved in those people's lifestyles were different than ours. The epigenetics were different. Their genes were the same. The genes in your parents and your grandparents weren't any better than ours but it's what you talk about biohacking. Leading a better lifestyle whatever that may be is a good idea.

People have sometimes said to me, "How can I live longer healthier lives?" They expect me to say I've got this one little thing I'll give you right here it's going to solve everything. No, the answer is the same advice that your grandmother gave you that you didn't pay attention to. Your doctor gave it to you. You didn't pay any attention how many cost too much but it's the same standard advice. Eat well, exercise well, avoid people with loaded weapons, fasten your seatbelt. This is not sexy advice. It's not terribly difficult but it's not something that most people do and yet there is a cultural change I think in favor of doing things like this.

I remember when I started practicing medicine 30 or so years ago, I tried to avoid telling people to take up yoga because it was a religion. Now it's okay. I can say this. I don't have to say stretching exercises. I can say yoga. Things have changed. There is an acceptance of this as a standard part of your care for yourself. A better diet whatever that may be. A better exercise program or stretching, yoga, meditation those things were sort of no-no back in the 40s last century.

Dave: we've definitely shifted there. Let's go back to telomeres. You talked about what they are. How are we going to go about changing telomere length? Walk me through the types of therapies that you're looking out for this.

Michael: There are a couple of them. What you got is there's an enzyme that's actually a two part enzyme but it's an enzyme in your body in each of your cells and its created from a gene. All of your cells have this gene that's usually turned off. Some of your cells occasionally make little bits of telomerase but generally you don't as an adult. The question is, how can we either turn it back on or [provide 00:34:37] telomere so there are a number of ways.

You could say let's fine something that turns on the gene, a telomerase activator and there are some on the market that may not be what they're cracked up to be but there are there. You could also say, "Never mind turning on the gene, let's just put in another gene." That sounds like taking a sledgehammer to a fly but maybe that's the opportunity to take. Another approach would be to say, "Never mind the gene and never mind turning on the gene, let's put in the telomerase which is fine if you can get it into the cells without it being destroyed. That is, can I administer telomerase by vein or mouth?" Not so easy.

Another way would be halfway between the gene itself and the protein there are messenger RNAs. Could I put one in that tells your body create this? The answer is yes

that works fine in the lab but it's very fragile molecule. There's at least one or two other possible ways but those are the big four. The telomerase activator as I say have been available on the market. Now let's see 2007 I think the first one came in the market. Here we're talking about astragalus [sites 00:35:44].

Dave: Yeah.

Michael: There is a lot of interesting evidence not overwhelming but good evidence that they have an effect on the age process and the number of clinical ways. For example, blood pressure, blood glucose control, osteoporosis, inflammatory changes, it goes on and on immune function. None of the data is overwhelming. It's not like somebody suddenly went from being an 80 year old to a 20 year old but there are significant changes and they're interesting. I think most of us in this field would say that those changes they're there, they're probably only about 5% as effective as what we're trying to get. The other approach is genetic. Go ahead.

Dave: Plus they're very expensive. For two years I took about 250 mg of very high potency astragalus extract every day. It was about 500 bucks a month for the form I was taking. If I was taking the most common brand, it would have been \$5000 a month whatever the dose was. Maybe my hair got a little bit less gray but man I'm not really sure. It was a lot of money and there are many other supplements I take where you can feel and see difference more powerfully than you can at least than I could with that supplement from that source. I'm a little bit skeptical that the bang for the buck is there. That cost as much as growth hormone which I know you're also not a fan of at all. It has as much as some of the other big gun approaches to be more youthful. Do you take that stuff? Do you take astragalus?

Michael: I do but I have the advantage of having it given to me. There are at least three issues with taking it. The first is, does it work? The answer is probably. Not dramatically but probably yes. The second question is, how much does it cost? You've already alluded to and the answer is far more than most of us would like to unless we're absolutely sure it was going to turn our lives around and make us healthy. Still it's a lot.

The third question is, are you getting astragalus or not? Are you getting astragalus for example. The answer is one if you pick it up from an herbal store for example in Chinatown the answer is it doesn't seem to be much effective [astragalus 00:37:57] present in the root that you get. There are certain sources that I think are probably highly reliable and there are others that I can't comment on because I just don't know. I'm fairly certain as a guess just knowing human nature that there are number of sources out there in the internet that are ineffective and they're taking your money and providing nothing useful. I don't know that that's true. That strikes me as typical human behavior in any commercial enterprise.

My strong feeling is that the TA-65 provided by [TA sciences 00:38:31] is probably the real thing. It probably is effective. I think I've got good reason to think that it certainly what is used for the scientific studies but still those same three questions. Does it work? Oh well. How much does it cost and am I really getting the compound I want? Those are

realistic questions. Not easy for anybody out there.

Dave: For our listeners listening to this and there's probably somewhere quarter million or half a million people will hear this interview, some portion of them are easily able to spend \$500 a month. It's a small portion of them and there's some others who could probably do it if they made some cuts and others who are like it's on the table right now. I've got a family to feed and I can get a little bit of ketosis in my life without changing my bills at all. There's a broad spectrum. For the people who can spend 500 or whatever more or slightly less per month to do it, do you think that it's a good idea to start taking the high potency astragalus extracts?

Michael: You put it exactly right. What you're doing is you're taking a bet. You're betting that that's really the astragalus side that's active. You're betting that it works and you're comparing that to the amount you'll spend. If I had \$20 million and was not the least bit concerned about paying my mortgage, my health insurance, yeah I'd probably do it in a heartbeat and I'd pick the most reliable source I could find. I [inaudible 00:39:55] but that's not true to most of us.

Dave: It's not.

Michael: They're trying to figure out how to cover the rent, what to do with the recent changes in healthcare cost and the cost of a million other things. The answer is I can't. Even if you believe it worked, even if you knew it was a reliable source, you can't afford it. That's reality.

Dave: One of the functions ...

Michael: I find something better than that.

Dave: One of the functions of this show is to bring attention to the really expensive stuff so that the cost will come down dramatically. If there's enough demand for things like this, the cost drops by orders of magnitude over the course of five or 10 years so I would hope that because of this conversation, five years from now instead of \$500 a month, it's \$100 a month or better yet you disrupt the heck out of it and you tell us what you're about to tell me which is why you could this more potent. What's above this?

Michael: You're exactly right. I got it involved with early progeria gets back 30 years ago or 40 years ago now. These are the kids who would age, aged seven look like they're 70 years old and I used to know them all. We'd get together once a year with these kids. In a typical year you'd have a three or four dozen kids globally that you know about with progeria. If I had a drug that cost \$36 million to make which is actually cheap these days, that would be a million dollars a kid and nobody could afford it. On the other hand if I've got a world population of billions of people and it cost me billions of dollars to put it together and that's a dollar a person, that's not bad. It's that market question. Have we got enough people out there to make it so that we can afford to treat this? Aging is not an [orphan 00:41:37] disease.

Dave: What are we going to do about it?

Michael: I look at the cost of putting together the gene therapy that we're going to try for Alzheimer's disease. Without getting into the specific numbers, for example when I do the Alzheimer's trial with 12 patients probably starting about a year from now, the major single cost would be putting together the gene therapy not the actual administration or the patient care, its actually creating the initial run of the gene therapy lead. As it turns out the cost drops to about 40% of that as soon as I open that up to dozens and dozens of people out there but just the first dozen. That's before you even begin to pull in technical changes and our ability to create these things. The cost drops dramatically.

Let me compare the kind of cost you're looking at and caring for Alzheimer's disease. Typically right now a month of good quality Alzheimer's care is not atypical for those to run \$10,000 to \$15,000 a month. That's a lot of money. I can't afford it. You can't afford it. In fact, globally we can't afford it but those are the same arguments people had in 1950. I'm serious when they were talking about the cost of iron lung's rehabilitation and leg braces for polio victims year 2000. The estimated was it will break the bank globally.

Polio is not expensive these days. It's a very small part of the world health budget. I think that's where we're going with Alzheimer's disease. We're going to start by being able to say, "Listen, instead of spending an average of say \$60,000 or \$100,000 a year on nursing home care for Alzheimer's, what don't we spend \$40,000 initially and get rid of the whole thing. What if we lower that cost even further by having more people and being able to do this as a mass treatment so maybe you get down to the cost of \$500 once every 10 years to prevent you from getting Alzheimer's." Now you're beginning to talk about something that we're not yet able to afford.

Dave: That's exactly how it works. It sounds weird but same is true if you look at your cellphone. It's got amazing compute capacity in it that exceeds the world's compute capacity 30 years ago. I think I got my numbers or maybe 35 years ago or something like that where it just boggles the mind. The cost is almost nothing whereas we're putting tens or hundreds of millions of dollars into building those early computers. The difference is shocking. It's happened with polio and it will happen with diabetes, cancer and Alzheimer's but it seems like it's happening really damn slowly right now compared to the amount of tech we have. Why is it so slow?

Michael: Dave I agree with you. Actually this becomes a very personal issue for me because I'm going to I think try to avoid naming names here but the principle comes through. There's somebody I like who has been involved in trying to take the same approach to a one off treatment offshore and avoid the FDA. The thought would be move faster and I agree with this because here I am already talking about being two years away from being able to demonstrate I'll be able to cure Alzheimer's disease and that means an awful lot of people will die in two years.

On the other hand, if this person is correct, what will happen is no one believe the results because it's only one person at a time. This person was in the middle age when it

happened and the measurements they're doing may not affect anything about Alzheimer's disease. If I'm either a national healthcare system, you pick your country, or a major insurer, you pick your insurer, or a clinic, hospital, a physician would I believe the results? The answer is no.

The risk is that this person will go on to do something that may be effective but since no one will find credibility in it, it'll end up costing \$5 million say per treatment and they'll only be able to treat a dozen people who have the \$5 million or several dozen whoever they find worldwide. I'd rather take a little longer which disturbs me because I don't want it to take so long but be able to get to the point where it only cost a couple of hundred dollars and I can treat everybody.

Dave: What does gene therapy look like? How would a patient go in assuming that it works and there's clinical trials? How would it be administered?

Michael: There are a number of ways. Ultimately we may be able to administer this with just a nasal inhalation but typically right now what we would do is an IV administration. Our example we'll probably going to do this through a lumbar puncture only because it's about 80 times cheaper and it's a big amount and it matters to us. You end up giving it as a shot and that's about it. We monitor you for a couple of weeks. In the FDA trial we're planning on doing, we'll be monitoring you minimum of six months and see how people do. Of course, following up beyond that. We anticipate seeing changes within a matter of months with our treatment but it would be in this case a lumbar puncture. I don't like giving [inaudible 00:46:41]

Dave: I had a lumbar puncture to have my own stem cells injected into my cerebral spinal fluid to help my brain stay young and probably to deal with some traumatic brain injuries as well as chemical brain injuries just because I plan to live to 180. What do you think about stem cells?

Michael: I think that all of medicine is changing. I just became the editor in chief of the new geriatric journal and one of the things that we're focusing on is not better nursing care, better social equity but actually curing disease. I think what's going on is that there are a number of thrust in medicine that are just beginning. They include gene therapy, epigenetics, cell therapies in general and stem cell therapy in particular. These are all things that are very different from what we've been doing.

Let me give you an analogy again. Let's say that I go back to medieval Europe and the Black Death is coming. There's a plague coming. You and I have come from the 20th century and in fact let's say we identify it's not Black Death. We know its small pox. You and I know something about small pox are trying to convince local people that if we use cowpox, we can inoculate them against small pox and prevent them from dying of small pox. All the local healers are saying, "Well you know we have willow bark and that will keep the fever down. We have a number of other roots and berries and herbs all of which may work but they don't prevent small pox."

A lot of medicine up until now has been this small molecular thinking. Can we find a

better statin? Again these are all small molecules. Those small molecules can be very effective for things. Again, willow bark or aspirin may be very nice for fever and headaches but it doesn't prevent Alzheimer's disease. It doesn't prevent small pox. It doesn't cure Ebola. If you want to deal with some of these more complex diseases and viral diseases come to mind but sort of age related diseases, you have to think a little further outside the box.

You have to realize that small molecules as much as they have a great history i.e. where would we be without penicillin maybe. They don't do everything. If you keep trying to look in the small molecular box for a solution to a large molecular problem that's outside the box, you're going to fail repeatedly. What I'm really saying is that stem cells, gene therapy and so on, this is the wave of the 21st century to treat diseases that we thought we could never treat before, that we can treat and can cure.

Dave: What do you do? You're 65 year old. You're the head of a new journal geriatrics. You've been studying aging. You're a physician. You're a neurobiologist. Walk me through a day. What do you do to stay looking as good as you look?

Michael: I get up. I meditate. I've been doing that for 50 years or something.

Dave: What flavor of meditation do you do?

Michael: I actually used to teach courses on this too. I used [to teach 00:49:39] yoga as well. I tend to do a Buddhist form of meditation I've been doing for 40, 50 years. I garden. That's my exercise. I've had people say "Well that's not exercise." My response is, "That's because you haven't taken 30 cubic yards of mulch and pitchfork it around the garden." [inaudible 00:50:00] realize that this gardening can be a full contact body sport. I garden and it's more than just exercise for me obviously. It's another form of relaxation and pleasure.

Not much. Exercise tends to be daily moving up and down the stairs. Have you ever noticed certain healthy people if they go up the stairs, they move up very quickly and they bounce up. Other people go up slowly and drag themselves up. It seems to me that many healthy people exercise in their day to day movements. I notice that you sitting in your chair and me sitting in my chair have not sat there quietly staring at the camera. We nod our heads. We move around. We move our arms. Sometimes exercise is more than just paying money to go to a health club.

Dave: I absolutely agree with that. In fact I spend not a lot of my time doing formal exercise about 15 minutes a week. I do other things that are unusual. What about supplements? You mentioned you take astragalus extract. You take a fistful? I take actually three fistfuls. Do you use supplements?

Michael: It probably depends on which year and what my mood is. One of the things that I've been doing regularly and I want to make fun of this in some ways is [brewer's yeast 00:51:12]. This derived from an old story about my mother during World War Two who was told she had to gain weight. The doctor said, "Listen you can either take brewer's

yeast as a supplement or you can take beer which of course had a lot of vitamins in those days." She said she tasted brewer yeast and I promptly became a confirmed beer drinker. Sometimes I say I take brewer's yeast for three reasons. One is that it makes me feel good. Two is that it's pretty cheap because no one advertise it and three is it taste so bad it's got to be good for you.

Dave: Have you looked any of the studies on that form of [inaudible 00:51:48] in cancer? There's some pretty good relationships between brewer's yeast and baker's yeast and incidence of cancer and candida and things like that. It's one of the reasons I steer clear of it. You may have seen a lot more than I have on it.

Michael: No, but I've seen some inconsistent results and some curious results. I always tend to look as I think we all ought to. At medical studies with a jaundiced eye not because they're wrong but because I still remember hiring a brand new physician in our service and probably about three months they came in with an article said this proves A works and my partner and I looked and said, "Yes but two years ago they proved it didn't work. Five years before that they proved it did work. Seven years before that they proved they didn't work."

The answer is been there before, seen that. I'll wait [inaudible 00:52:40]. I think the same is true of a lot of this data. It is interesting and there probably is something in it but sometimes the answer is just aren't in. I also see the same thing with regard to telomere data particularly where people look at the wrong thing. For example, one of the problem is that people will measure your telomeres in your peripheral white cells. Very easy to do. You got a finger prick I can measure. The problem is that almost nobody dies of aging leukocytes. You die of aging vascular cells. You die of aging cells in your brain. You have problems with your knees because of your chondrocytes. Those aren't leukocytes.

The second problem is that those things are being turned over all the time. They're turning. If I have a lot of stress, a viral infection, a bad diet, my immune system [inaudible 00:53:29] turning over at those leukocytes so that the peripheral lymphocytes that have short telomeres. If I then begin to meditate, better diet, I lower my stress, I get a dog, you name it, whatever get some more sleep, get rid of night shifts, what you find is your telomere links begin to increase but it's because you're no longer turning them over as fast as peripherally. It doesn't mean you're younger.

It means you're not as stressed anymore which is good but if I looked at your marrow cells I'd see they're solely still ticking away, slowly getting older. It's still good that you did all those things but to measure peripheral lymphocytes as a measure of whole body aging, it's like me saying, "I'm going to measure one city block in the Bronx 50 years ago and today and if now younger people live there, that means the whole country got younger." No, it means the [inaudible 00:54:17] moved out and a bunch of yuppies moved in. They started new businesses and they've got a bunch of three year old kids. No wonder they're younger but the rest of the country is still getting older too.

Dave: I see that exactly. Now we have that same group of people listening who are happy to

spend \$500 a month on supplements to at least retard aging. How should they go about getting their telomeres tested? What's the gold standard test?

Michael: that depends on realism too and it's not easy. There are at least two commercial sites that I would think about. One would be Telomere Diagnostics out in California. The other would be Life Length in Madrid. They measure slightly different things. The Madrid study is looking at average telomere lengths and the one in California is looking at the shortest telomere lengths. Both of them tend to look at lymphocytes. If you want to get some general measure probably it's easier just to use Telomere Diagnostics in California because it's in the US. You don't have to ship things elsewhere. I would just take the result with a grain of salt.

Dave: how would a nonmedical professional go about taking the results with a grain of salt? What does that mean? I have actually two test kits from the last American Academy of Anti-Aging Medicine. I went there and picked up a couple of test kits. I don't remember the name of the lab. Every time I've tried to get my blood drawn for them, it's usually like a quest. "We won't fill that vial with your blood." I'm like, "It's my blood and my vial. Put it in there you bastards." Anyway, just a side note. I still haven't done this because I'm not a doctor and I probably could just fill them myself but I'm lazy. I don't have those results yet.

Michael: I'd happily do it for you. I'll stick you with needles any time Dave.

Dave: Thank you.

Michael: The telomere diagnostics one in California send you one of those little needle prick things where you prick your finger and you get one drop of blood and that's it.

Dave: That's convenient.

Michael: Yeah. I think its \$89 and you could do it in the quiet of your own living room any time.

Dave: We'll put the link on the show notes here and I'll make sure I get the right name for that. I haven't done that one. Does it work? Would you use those results or is it so grain of salt that its nah?

Michael: It's probably reliable in a sense that is let's say that your 60 year old and it comes back and suggest you've got a telomere health at 50. That's good news as opposed to getting one back that says you've got a telomere health of 80. The problem is you really have to intercept it in terms of how's your life been going. As I say if the last 6 months have just been going through hell. I had divorce. My dog died. I got fired from my job. I'm on this terrible diet of eating cardboard everyday plus junk food as well. Then I think you can expect that those numbers are going to be unrealistically bad for you.

If what you've done is done a lot of good things, then getting confirmation that your telomeres are nice and long, shouldn't surprise you. That's why you've been doing good things for the past five years. It's got some value but they tend to get over read. About

once every week there's another study out that suggest that if you eat vegetarian diet or you name it, that somehow it'll make your telomeres longer. Then answer is it might but on the basis of the data that you published.

Dave: I am really interested in once a year. I've drawn my blood 97 I've gotten tested about every year or so with a whole bunch of biomarkers, with one of the very early A4M guys. It's been really informative because you can make lifestyle changes and see the change in the curve. Your vitamin D levels go up, you got to get more sunshine. Your inflammation levels go down when you eat less [inaudible 00:58:14] and all these things you can do to get your parameters about where you want them and you can test changes. If I get this \$89 test every year, is it going to tell me whether you've done good last year son or is it really not going to tell me enough to be useful?

Michael: I think it will tell you whether you've done well in the last year. On the other hand, I mean most of us not always. Most of us already know that.

Dave: Good point.

Michael: You knew that when you were young and you said, "I'm going straight to hell physically and you may [check this 00:58:46]." I don't think it took any deep knowledge to figure that out. Having said this, some people don't. Some people suspect they're in trouble don't want to face it and don't want to do anything about it. This provides an objective measure that you're in trouble I suppose or that they're doing well.

Again, I can't help thinking what I said before is still true which is that your mother is cheaper. Your doctor told you the same advice but having said that, I really do believe that telomeres are a critical measure of what's going on in terms of cell aging but you're measuring blood cells and you're not just blood. There's a lot more to you than just blood. It's worth some but it's not the be all and all of aging. It just isn't.

Dave: I'm still working on getting the big nugget for people listening to the show today. Other than maybe meditate, exercise and eat right, what are they supposed to do given what you know now to influence the length of their telomeres given that the gene therapy isn't available yet? Is there at least a directional thing you can offer besides the main lifestyle epigenetic things?

Michael: Again, most of it isn't sexy and it boils down to the old moderation in all things. For example take exercise. I could go out and try to run 100 miles a week, what's the optimal for my body? Am I increasing the aging of my knees even though I'm making it better for my heart? Good question. I could have an optimal diet whatever that is, but is that any better than a really pretty good diet? I think that for me diets are [wine and coffee 01:00:24] in some ways. I can tell a difference between a god awful wine and an okay wine. If it's okay one versus an incredibly expensive very good wine, the answer is "All right I'll take your report." Same thing with coffee.

Same thing with diets. If you have a terrible, terrible diet, you're in trouble. If you have a pretty good diet, that's good. How much better is an excellent perfect diet than a pretty

good diet? It's probably not worth all the stress you put yourself through trying this all out. As I sometimes say to people, "If I can prove you could live double a lifespan by living in the basement in the dark and eating sawdust, would you do it?" "No, I'd have another chocolate mousse."

The stress of trying to engage in a diet that just does not fit your body, maybe worth it in one sense but costly in another. It needs to be a balance between yes you need a pretty good diet but after a while chill out. I used to get these patients who'd come in and they'd say, "Doctor my blood pressure is too high." I said, "How do you know that?" I said, "I took it 12 times so far today." The best thing is to throw out your blood pressure cuff because you're already causing damage to your body if you're that nuts. The same is roughly ... again I don't mean to overplay this but in terms of diet. You need a good diet but if what you do is end up stressing yourself worrying about the whole time, you'll just undercut yourself. Chill out, relax, go meditate.

Dave: There's this thing called orthorexia and the whole point of the BulletProof diet here the way I recommend is look know what direction perfection lies in and just lean that direction. You don't have to be perfect by a long shot but just know what direction it lies because a lot of people like, "I think I eat healthy. I just eat two cinnamon buns a day instead of four." Maybe you could just tilt that a little bit better in the right way.

Michael: Every now and then you need a glass of champagne or a piece of chocolate but you shouldn't be drinking champagne and eating chocolate all day. My god, you know.

Dave: If you blend them with butter, it's okay.

Michael: There you go. We're all nuts here. We're just a little nuts.

Dave: We are indeed. This has been a fascinating and fun interview Dr. Fossil. I want to ask you one more question and I think you may have already answered it but I would just clarify it. I ask every guest on the show this. People who are authors and researchers and various other people who have done cool things. If someone came to you tomorrow and said, "Based on your life's work and on your life, so basically everything you know, I want to perform better at everything I do. Like interview ant to kickass at life by just being a human being. What are the three most important things I need to know?" What would you tell them?

Michael: First thing is figure out what you actually want in life. I can't tell you how many people I've run into who want to be famous until they mistakenly realize that that's a disaster. I have a friend who wanted to be chairman of a department at Harvard who became chairman of the department at Harvard and he's unhappy. He's got a divorce. His kids hate him. He doesn't like his job. Does it occur to you that the goal that you have is wrong?

I think that the key for our lives many times is to pick the goal. If your goal is to be the best plumber in the world, you should be that. If the goal was to raise kids that you really enjoy as part of your family, that's what you ... If your goal really is to make \$10

million and that will make you happy, you go right ahead. Finding that goal is not so easy. It's sometimes not a matter of just getting what you want or kicking ass, it's somewhat figuring out what ass you want to kick and that's not easy. We've tended sometimes to kick the wrong one.

Dave: Very well said. There was one. You got two more.

Michael: Never give up. Never, never, never give up. I used to say pretty simply in writing that tools of writing are one, stop talking about it, just write. Stop telling your friends you're going to write a book. Write the book. Don't talk. The second rule is never give up. The classic was [inaudible 01:04:20] getting turned down by 13 different publishers. Don't give up. So many people have given up. Stop giving up. Persevere. It's not easy. It's painful. It's annoying. I've been working on this for 20 years and [there seems 01:04:34] people just don't see it and now we're involved in trying to get the financing to take this Alzheimer's trial.

If I give up, it definitely won't do. Henry Ford was a real pain in the tush. What an obnoxious human being in many ways but he's got all number of incredibly good quotes and the classic was one about that he came up about "Whether you think you can do something or cant you're right." If you're thinking you're going to fail, you're going to fail. If you think you're going to do it, you guys still fail but you're going to find out.

When I was in high school, my guidance counselor told me I was too stupid to go to college. Thank you very much for your opinion. Thank you very much, I appreciate it. Kiss off. Never take no for an answer.

Dave: I love that one. Know which ass to kick and you never give up.

Michael: As I say just do it. That was part of the ...

Dave: Just do [inaudible 01:05:28].

Michael: Yeah. Don't talk about it. Don't say, "Someday I'm going to learn a foreign language." No, that means you're not. Someday I'm going to travel the world. That means you're not. Someday I'm going to make a million. That means you're not. Someday I'm going to marry the right person and have kids. No, just do it. Stop yapping about it. Don't tell your friends. Don't put it on Facebook. Don't tweet it. Just do it. If you go ahead and tell somebody afterwards what you're doing go right ahead but talking about it and doing about it are not the same thing.

One other things we've gotten involved in this whole Alzheimer's work is people come to us for interviews. As I was doing some world report called me I said, "Don't mention my name. Don't mention the biotech company because whatever you do I've got all these emails to answer. I don't want publicity. I want to get the work." I shouldn't be talking to you at all Dave. Please don't tell them who I am and don't tell them anything about me. Publicity is not the same as getting work done.

Dave: It's not the same as getting the work done but you've done something that's actually a gift for people. As a fellow author you spend thousands and thousands of hours on writing a book. You condense so much of your life's work into this and it takes someone four to six hours to read the average book. In terms of leveraged time, there is no better leverage than buying a book for 20 bucks because you're getting thousands of hours from an expert. It only takes four of your hours to absorb it.

Publicity here is people should read your book because they're learn this stuff and the odds of them reaching out and talking to you are pretty low unless they're working for media and you're looking to sell more books or hopefully to get some support whether its funding or regulatory support or whatever else for the studies you're doing because its important work and people should know important work is happening.

Michael: Dave you remind me of a professor at Berkeley who we were talking about ... I was finishing writing a book and she said, "Writing a book is just like having a baby." She said, "At about eight months through one, can't you believe you've been at it this long. Two, you can't believe that it'll ever come to an end. Three, you cannot for the life of you remember why you agreed to do this in the first place."

Dave: Exactly. Having just turned my manuscript in about three weeks ago, I think I'm at that stage right now.

Michael: You've given birth. You're happy now. I hope that it was post mental depression for you. Hope you're enjoying it.

Dave: I think my copper levels are high enough but I do believe that I probably shortened my telomeres a little bit writing the book because you're running a company, you're writing a book all night long every night for a while I could do that but it was worth it.

Michael: Oh you poor you. Good for you. Congratulations Dave!

Dave: Likewise, congratulations on your book. For listeners its called the Telomerase Revolution by Dr. Michael Fossel, F-O-S-S-E-L. You can check that out on Amazon. Anywhere else that they should go to find it?

Michael: It's also out in seven languages and 10 global markets now.

Dave: Seven languages.

Michael: Two different Chinese editions, three English editions, French and Wales, Russian, Spanish, whatever.

Dave: Must be in Japan, right?

Michael: Strangely enough no although my first book 20 years ago was apparently a bestseller in Japan.

Dave: I got back from Japan three days ago and it turns out the BulletProof Diet is 160,000 copies number one bestseller in Japan and I had no idea. I went there to do book signings. It was completely unpredicted but I think they would love your book.

Michael: Hopefully they do.

Dave: [inaudible 01:08:55] rights.

Michael: My book will never pay the mortgage, never make me [inaudible 01:08:57] doing. It sounds like yours will do better and I wish you the best.

Dave: Thank you so much. I appreciate you being on BulletProof Radio and have an awesome day.

Michael: You too. Thanks Dave.

Dave: If you enjoyed today's episode you know what to do. Head on over to your favorite bookseller and pick up a copy of the Telomerase Revolution. There's a lot you can do to live maybe forever. Certainly to live a lot longer than you were going to live if you did nothing and that's what I'm doing. You can join me in learning about that stuff on BulletProof and read this book telomerase matter, mitochondria matter, epigenetics. This idea that the environment around you changes your biology is terribly important.

The idea that you can take control of that with biohacking is really important. By reading a few books like this, read the BulletProof diet and read books by the dozens and dozens of other authors who've been on BulletProof radio, you can have a toolset that lets you not just live longer but actually feel better, have more energy and be a nicer person while you're living longer and that's really the golden thing you can find here. Have a beautiful day and if you like this episode, please head on over to iTunes and leave a five star review. Only takes you a second and it actually matters. I look at those every day. Thank you.