Speaker 1: Bulletproof Radio, a station of high performance.

Dave: You're listening to Bulletproof Radio with Dave Aspery. Today's cool fact of the day is that human skin bacteria have cancer-fighting powers. Certain skin-dwelling microbes might actually be anti-cancer, we'll call them superheroes, that can stop uncontrolled cell growth. This is a surprise discovery that might lead to probiotics for your skin that can maybe prevent skin cancer. This bacterial compound stops DNA formation.

Mice that were covered with Staphylococcus Epidermis, which makes this compound develop fewer tumors after exposure to UV radiation, compared to those that have a kind of different bacteria. These findings highlight the potential of the microbiome to influence human disease according to the researchers who did this. This was published in Sciencenews.org. This is becoming more and more interesting.

We know that our cells are run by ancient bacteria called mitochondria. We know our guts are full of different species. We know that the cells, well, the subcellular components that are ancient bacteria, talks to the microbes in our gut. They probably talk to the microbes in your skin. It's becoming more and more interesting as we develop the tools to do this. What this means is covering yourself in antimicrobial stuff might just be a bad idea.

As we're getting into the show, if you like Bulletproof products and you use Bulletproof coffee or Smart Mode or any of the other supplements, collagen, Brain Octane, if you take a second, head on over to Amazon and leave a product review for me, I would be truly grateful. It helps other people know that there's a difference when you use Brain Octane. It's a really easy way to say, "Hey, thanks for making good stuff," and I pay a lot of attention to those. Thank you.

A quick shout out to my friends at Greatest.com. They just did a very detailed, quantitative analysis of people to see who's having the most influence online in health and fitness. I was amazed and grateful to find that I was number 16 on the list this year. Thanks, guys for doing the work of quantifying, who's reaching a lot of people and making a difference. I appreciate it.

Today's guest is a really interesting guy. He's a Seattle-based developmental molecular biologist who's looked at isolating and characterizing genes involved in human brain development and the genetics of psychiatric disorders, but that's probably not why you've heard about him. You might've read his New York Times bestseller called Brain Rules, where he talks about how brains really work and how to redesign our workplaces and schools to match.

He came out then with Brain Rules for Baby, which tells parents like me and early-childhood doctors and educators about brain science, so you can have happy, smart and moral kids. His last book is Brain Rules for Aging Well which talks-

John: That's … I think that's sporty of them, David.

Dave: Exactly, "for waging well." Also, we're talking to a guy who's just a phenomenal human being who also is mostly a private research consultant whose work in biotech and pharmaceutical industries and mental health and not necessarily the normal academic background that you might expect from someone with this level of knowledge. His name is none other than John Medina. John, welcome to the show.

John: Thank you, David. Thank you for having me on.

Dave: Now, I just have to ask you, you're weird. How did you get to be a person who studies these fields? You're in a broad field. You have genetics, cell biology, mental health. What drives your curiosity and your relentless pursuit of these fields for your entire career?

John: Yeah. Well, I didn't start out being a developmental molecular biologist. I was a professional animator and a graphics artist before I was a scientist.

Dave: Because, that's so obvious?

John: Well, it's all about information processing. I was-

Dave: Yeah.

John: … what was called a tweener in those days, back when you did cell animations. I'm sure some of your audience will remember back through the days of cell animation. A tweener is, you'd have the real artist who could do the key frames, so one frame and … time zero and then the other frame at time 19, so you're going to have a 20-frames-per-second. The tweener, tasked to take the two objects, one at zero and one at 20, and fill in all the other activity that has to occur in order to make it happen. I was a tweener for a while.

Dave: That drove your curiosity in this space. You started out animation? What, how's the transition here? I talked to all of these people who are doing big things and looking at things in a new way. Most people have either weird brains or childhood trauma or something pushed them in that direction. Because, you don't sound like a typical animator here. What caused you to suddenly wake up one day and say, "I care about the brain and the cell and mental health?"

John: Totally. It shows you the power, David, of a good teacher. Because, I had … I did my undergraduate work at the University of Washington and I had a teacher who came in and said that I've … That's why I'm doing my animation and doing lots of things, but I was always good at math and science, and I had to figure out what I was going to do with the rest of my life.

I took this introductory on microbiology class. The professor had just helped clone the genes that make fireflies glow in the dark. You would know it as luciferase, the luciferase system. He stuck it into a tobacco plant and he brought the tobacco plant in class, David. It now, the tobacco plant glows in the dark just like a firefly does.

He said a magic sentence that changed my life. Here's the sentence. "You know? It's just A's, G's, T's, and C's, the nucleotides in one, in a certain amount in a certain order will give you a whale. Change the order and change the amount and you can get a mosquito. Change the order and change the amount again and you can get a palm tree. You can mix and match them like paints on a pallet, which is why I can take a beetle's gene, luciferase gene from firefly, stick it into a tobacco plant, and have a reasonable shot of it working together if you hack it a little bit."

I was gob-smacked. I went up to him when the class was over. Because, I said, "Art? Science? Can I wash dishes in your laboratory? Can I lick your boots? I would love to know more about this." He just got in his grant, and with the product to this he said, "Sure. I needed a bottle washer."

I went into his laboratory and I have never left, that's the way to say it, from this day to that. It's all about … Animation has a lot to do with information processing, not just the script that you have to work with but you actually have to draw it. You're actually engaging the brain in a lot of different levels when you're animating. I don't find that information processing much different between the two. In fact, enough compatibility that, well, I ended up getting a PhD in developmental molecular biology and leave the animations for a light tryst.

Dave: That is an incredible story. Is there something about the mental skill of envisioning the future 20 frames from now and taking those little pieces that forms the way you think about things? Did that just wire itself into your brain?

John: Well, it actually has a formal term. It's called mental time travel.

Dave: Yeah.

John: That's actually the term for it. It's usually is related to a cognitive gadget which we probably should talk a little bit about, whether we're talking about kids or aging brains, and that is executive function. For your folks in the audience who don't know what executive function is, the pithy sentence is, it's the brain's natural ability to get things done. That's what executive function is.

Dave: How does it work?

John: Well, it has two peers associated with it. They don't seem related at first but they're the same neural substrate. Is where the top of the forehead with the prefrontal cortex is going to be talking to the interior of the brain, the amygdaloid complex, what we often call the reptilian brain.

The ability to set up a reciprocal, electrical relationship between those two is the neurological substrate for the following behaviors. A, cognitive control. Executive function is built for cognitive control. What I mean by that is, if you have a whole disparate set of variables and you see that right be a commonality, you can make a gist to detail heuristic really quickly out of them, and you begin to organize it better.

Also, your ability to shift from one thing to another and then come back to it, that's all related to cognitive control. People who have ADD, ADHD do not have much cognitive control on that area. It's often catastrophic for them to be interrupted from a task and then move to another one and then cut them back, they usually can't come back very well. The first pillar of executive function is that.

The second pillar is related to it although it doesn't seem that way. It's emotional regulation. It's ended up, people who have poor executive function in this category, really are hard to be around, Dave. They're moody.

Dave: Yep.

John: They don't have affective control. They don't have a lot of things that you can work with. Most importantly, they don't have impulse control. Because they don't have impulse control, the not a great relationship with the deep, interior structures of the brain, they can have anger management issues or they get addicted very quickly or they can't focus on something enough to get going.

People with strong executive function are often really good at math. People with poor executive function are often really poor at math. A good example for the impulse control side, if you get a math problem and you don't understand it, if you have poor impulse control, you will throw it out because, "I don't understand this. I hate this stuff. I'm going to go away."

If you've got good impulse control, you'll say, "I don't care if it's uncomfortable. By God, I'm drilling down on this until I get it. Because, regardless of how I feel about it, there are certain goals that need to be met, A, B and C." That's why both emotional regulation and cognitive control actually work hand-in-hand in a single gadget we call executive function. Mental time travel is a part of that.

Dave: Tell me more about this mental time travel?

John: It's the ability to plan and into the ... We call, it's also sometimes called virtual transposition. It's the ability to plan something in advance and understand the consequences of that planning before you do anything. That's why it's virtual, okay? It's actually not happening yet. Transposition, you're transposing yourself into a given set of circumstances. Good mental time travel people are really good at plot prediction, which means they usually hate most Hollywood movies.

Dave: Okay.

John: They know. They've seen this story before. They know how this journey ends. They've got great mental time travel. I just finished the book on the teenage brain. A hallmark of the developed, undeveloped teenage brain is that they suck at mental time travel. They don't understand the consequences of their actions. They don't understand the future impact of present behavior. They don't understand the long-term consequences of short-term interaction.

Dave: Does that tie into the fact that your prefrontal cortex isn't really fully developed? You're about 24? Is it the prefrontal cortex that's causing this mental time travel, or is this a different brain structure?

John: Well, it's better to say it's not. The prefrontal cortex actually has a fair amount of mature structure in it but-

Dave: Yeah.

John: … It's ability to communicate with the deeper parts of the brain, that's where the immaturity is. That takes a while. In fact, you can show this is the work of Jay Giedd. Are you familiar with Jay's work at all, used to tell it at University of California, San Diego?

Dave: What was his last name?

John: Giedd. G-I-E-D-D.

Dave: I have not seen his work.

John: Yeah. He's also at NIMH, a ridiculously good imager and a powerful advocate for understanding the development of the teen brain. He's put a lot of the teen brain on the map. Here's what he was able to show.

He was able to show that the deep, interior structures of the brain … I'm going to use the word amygdaloid complex. What I really mean by that, if we just stay with the amygdala, for your listeners who don't know about the interior brain structure, if they can envision a scorpion in the middle of the brain, okay? If you can think of the scorpion and the two claws of the scorpion, okay?

That's the amygdala. You've got two, one on each side. The legs that connect the claw to the body of the scorpion, those are the hippocampi, the hippocampus. There's two of them, one on each side, and they connect the amygdala to the center structure which has lots of different names, the biggie is probably the fornix.

The amygdala, those claws, it's a great metaphor for this because the amygdala is involved in things you feel passionate about or that could hurt you or that you love or that you hate. It's the center of your emotions, and not just the ability to generate the emotion, but your ability to generate a memory of the emotion. Those memories, that's why it's so closely tied to the hippocampus which is involved in memory formation.

Well, that structure, David, develops first. That gets on, it gets online around 12 or 13. Once it's there, it'll stay there, your prefrontal cortex, to get to the heart of your question. The ability of the forehead to brain, the places where you are more mature or more adult, to communicate to those structures is not fully mature until age 25.

You are passionate before you are wise, for the developing brain. Jay even thinks he knows the reason why. Have you ever? I'm going to go off on a monologue here but you want to make a discussion, be careful.

Dave: Go for it. No, tell me.

John: This to me is really interesting because he brings in history. As a former animator, I just keep thinking, "Okay, how would I draw this?" The Habsburg line, we're going to look at the Spanish Habsburg line, particularly Charles II, the endpoint of an incestuous series, multi-generational, having sex with your relatives. We could also look at something more recent, Queen Victoria and Prince Albert. Do you know they were first cousins?

That was a problem because they had sex. They had sex and had lots of babies and had lots of deletary mutations. In fact, the more consanguineous sex, which is that's what that's called, with blood, the more you are having sexual relationships within your people group, the more likely that mutations are to occur.

What Jay did, Dave, is that he said, "Okay, let's stretch that back to the Serengeti. If we are in our hundred gatherer stripes on the side of the [Ngorongoro 00:14:23] crater walking around in groups of 40 or 50 probably, [Robin Dunbar 00:14:27] would say, no more than 150, tops." Say, 40 to 50 is probably more like it.

What's going to happen when you have babies and those babies grow up and they hit puberty? Because, now they were [Andy 00:14:39], now they want to have sex. If they have sex in that people group, in two generations, they'll be infertile. That's what happened to Charles II. His tongue was too big for his mouth. He was drooling all the time. He had huge mental health issues, probably schizophrenia.

He was infertile and he was a train wreck. He was the last of the Habsburg line by the way. Actually, his deficit led to these wars of Spanish succession.

Dave: Wow.

John: Because everybody was pissed off. It's got to be, it's a big deal. Jay knows it's a big deal and he said, "What are the hundred gatherers going to do?" Given, they are close together. Well, he says this, "If you did the following, if you made the teenager, when they're growing up, have a certain suite of behaviors, such that they feel all the passion that you would normally feel … " We have that 12 or 13, "Are completely pissed off at your mother and dad and your family grew in such fashion that there's no way in hell you're going to have sex with them-"

Let alone, even have just the whole idea of being embarrassed. "If you create a behavioral firewall yet at the same time, stunt their mental time travel ability, and now to the point, so that they cannot understand the consequences of their own action very well, by God they will leave the 40 or 50 group and they will strike out on their own." That's a hazardous thing to do in the Serengeti and the Ngorongoro crater given the weakness of the homo-sapiens body structure.

Well, if you have problems with mental time travel, you're not going to give a riff.

Dave: Okay. This makes so much sense.

John: Yeah. You can't stand your uncle. You can stand your dad. You want to have sex. You're going to … You're okay. You can also show that risk-taking behavior also increases in the teenage brain. Jay thinks that's the direct result of the neurological developmental sequences. Such that, you leave, go find another people group and have your sex and your babies there and let's mix up the gene line and never have Charles II until you have an aristocracy.

Dave: Yeah.

John: What I used to say in the book actually is that, the next time your teenage daughter swans up the door and slams … and runs up the stairs and slams the door in your face or parent, get down on your knees and thank her. That behavior saved the species.

Dave: That completely makes sense, and so much of what we do now in cities of a billion people is driven based on these small caveman things. Even our sleeping patterns …

John: Yeah.

Dave: … are tied back to that, which is irritating. Can we hack that? I mean, I do Nerf a few back with my kids, help them integrate their brains better. During their Waldorf's school, they play two hours outdoors every day. Man, my daughter's 11.

John: Yeah.

Dave: You can see the little beginnings of a teenage brain in there. It might … I love my kids. They're fantastic and you know, because we were all teenagers too, that, yeah, "Why didn't I do all that stuff back then?" Like you said, it's because they don't understand the consequence of their actions, you don't have wisdom. What do we do as a society to help our teenagers maybe suffer less?

John: Well, we have … I have a 21-year-old and an 18-year-old, so I've just come out of the Star Wars IV ending, where the X-wing is leaving the Death Stars of experience.

Dave: What?

John: There are several things that really helped us out. I'll answer that personally and then I'll answer it in the purity also if that makes sense, will do to. What really helped my kids, Dave, is that I told them what was going to happen to them when they were age 11 or 12. It was prophylactic as a strategy.

I said to them, in fact, I showed them some of Jay Giedd's stuff. I said, "This is what your brain's going to look like, and these are the behaviors that we know you are likely to

experience." One of the great warnings that I gave them, and I would urge anybody or even you, Dave, and people to have close to teenagers.

Do you know what the average age of onset of any mental health disorder that exists in North America? Do you know what it is? You probably do.

Dave: It's probably around 13, if I remember right.

John: Fourteen point one. Yeah. Close.

Dave: Okay. I was close.

John: Yeah, real close, 14 years of age. That's true. The psychiatric world, you can divide the behaviors into what I call thought disorders, schizophrenia, probably borderline personality. Then, the affective disorders, anxiety and depression, and even some mixes and matches, schizoaffective disorder, which has aspects of both. It doesn't matter how you want to categorize it.

Age of onset for all of them is 14 years of age. We actually think that most mental health issues that we deal with are disruptions in the normal adolescent developmental program in the brain. It's because it's an extremely vulnerable time, the hormones are beginning to surge and Darwinian priorities of projecting genes are beginning to happen. You have lots of things.

What I did, Dave, with my kids, to the personal side, I told them, "This is what's coming. If you begin to feel, if you have suicidal ideation, I would love to know that in advance. If you have, you begin to have feelings of anxiety, I would like to know. If you're just embarrassed by me, and you will be, because I'm a big presence, I will embarrass you. That I guarantee."

Dave: Isn't it that our right as fathers and mothers, to embarrass our kids for fun? I thought that was part of being a parent?

John: Well, I just don't want them to feel guilty about it when they do feel that.

Dave: There you go. Okay. That the feelings are normal, so you get rid of guilt and shame which are destructive? Okay.

John: Well, exactly. The guilt actually makes a recursive loop out of most anxiety. You feel guilty so you get anxious. You get anxious so you feel guilty. You go back and … If you could snap that loop or at least address it so that they have the tools, and this was the first time I showed my kids-

Jay's got these beautiful for-test-live MRIs, so I was able to show them some really fine grain imaging. They started getting into it. We'd have an ongoing conversation about what was going on as their little lives developed.

From a personal point of view, just for arming them with what's going to happen, and then it's okay that it happens, that there's an evolutionary reason for it that is so powerful, it actually saved the species, you don't have to feel guilty when you slam the door. You just have to know why you do it.

Dave: That is really powerful advice. I think a lot of people listening, and by the way, there are a bunch of teenagers who listen to Bulletproof Radio. I've talked to the bunch of them at airports and on the street. If you're listening to this, and now you know something about your brain you didn't do, and for parents, I think that is profound advice. It's not really what they taught me in seventh grade. Has this entered the school system at all?

John: No. Most … It's one of the reasons why I wrote the Brain Rules series, Dave. Most of this stuff just sits. It's gorgeous work. It was well-funded in its time. You probably should have and it sits on their shelves and gathers dust.

Dave: Okay.

John: It gets filled, why I have a passion about it, is that it gets filled very easily with mythology, it's because people are really interested. You only use 10% of your brain. Yeah, right. The default resting states, 40%. There's no such thing as a left-brain personality and the right-brain personality. You need both hemispheres to make a freaking personality. You don't [inaudible 00:21:41]. It is, frankly.

What is a personality? Why? I have no idea. We don't. We don't really know. In the peer review, to say what also you could do with teenagers, and would we certainly get to the aging in a minute, but the … what you could also say with teenagers is this, the peer review shows that you can aid and abet executive function. Notice how I said that. I didn't say-

Dave: That was good.

John: I said, "aid and abet it." That, it can more comfortably develop if you're aerobically fit. If you're not aerobically fit, executive function scores go down. This is the work of [Roy Baumeister 00:22:13] and [Jane Cagney 00:22:14] and folks that have done what's called the self-control scale, and they've done a bunch of good, solid psychometric tests, have strong reliability scores, good internal and external validity.

You can actually measure people's executive function, and if aerobically fit teenagers have much higher executive function scores than aerobically unfit teenagers. In fact, I advocated in the book, Attack of the Teenage Brain, that we should redesign schools. At the center of the schools should be a gym, and you have an aerobic workout all the time. In fact, there would be a school uniform in this model. It would be gym clothes.

Because, it's so powerfully aids and abets executive function that it actually reduces the psychopathology rates, both anxiety and depressive disorders. It's especially good for affective disorders. It works somewhat for the thought disorders. That probably requires something of a more strenuous effort.

In terms of the things that, in the United States right now, we are dealing with a crisis of suicides. CDC, as you may be familiar, just came out and showed, since 1999, there's been a 30% increase in the rates of suicide. An executive function with impulse control, if you have strong impulse control, that just doesn't happen. You ought to be fit.

Dave: All right. I think I just came up with the way to save all the teenagers. You tell them they can only charge their cellphone if they generate the electricity on a treadmill or a bike, right? Would that solve our problem, right?

John: Very good, but I'd put a delimiter in that cellphone so it took a lot longer to-

Dave: Of course, and there might be some resistors in that line. Sorry, guys. I didn't tell you about that until you're 21. Okay.

John: [inaudible 00:23:53] your teenage audiences with apologies. The adults are now conspiring not, actually, on your behalf, but not in your local best interest. There's a second thing that you can do though that we also did in our household but is also now anchored in the peer review.

That is something I had to. Hopefully, I'm a nice guy but I'm a pretty grumpy scientist. As you said in your introduction, most of my life has been spent as an analytical research consultant. I'm, literally am hired, the [Paratrooper Neural 00:24:23] Project and try and poke a hole on that. That's my job or was my job. I'm retired.

I've started two brain research institutes in my time where I did virtually the same thing. I'm in the Department of Bioengineering at the University of Washington Medical School. There, I do the same thing.

Dave: Do you ever know Gerald Pollack by any chance?

John: I know Jerry. Yeah.

Dave: Right. We just … Bulletproof just funded research in Gerald's lab on water biochemistry.

John: Yeah?

Dave: Yeah. We wrote a sizable check there to help understand some of what's going on for mitochondrial works.

John: Sure.

Dave: I was guessing you must be colleagues because he's also bioengineering at the same school. Anyway-

John: What? Well, you tell him I said, "Hi." I helped him win some of the layout, a book that he wrote a number of years ago.

Dave: Beautiful. Okay.

John: [inaudible 00:25:02] Yeah, yeah, yeah. He's a great guy. Okay. The but, we spend saying all this about. In fact, it's called, now that I've had professional relationships with a number of organizations over the years, they call it the MGF, the Medina Grump Factor.

Dave: Okay.

John: Because, I work with psychiatric disorders, Dave, I have to be a pretty good behaviorist, but I have to be able to link that to a bunch of cells, so I have to do some fair imaging, but my home base are the molecules. I am a DNA jock. The ability to speak of those three dialects of brain science, if you don't line those up in a row, it's not like I can live in my standard deviations with the behavior and expect to isolate a little snippet of DNA, it's not going to happen.

The Grump Factor has to be fairly strong and available. I'm going to use word mindfulness and I'm going to immediately run to my Grump Factor.

Dave: Okay.

John: Because, meditation and if you look through that literature, it's actually, some of it is excellent, some of it is as sloppy, so sloppy that it looks like it was done with an undergraduate without any peer review. Yeah. There's even books you get.

There's a book you can get called Mindfulness for Dogs. I know. Anybody will care what baseline, what psychometric test you can you give a dog that would make sense. There's no un-mindfulness for cats. I tend to stay away from it, except that shame on me. Shame on Dr. Medina.

Because, the work of John Kabat-Zinn who actually puts some of the behavioral work in the mindfulness on solid reproducible footing, and people like David Creswell at Carnegie Mellon, I'm not sure if you're familiar with Dave's work or not.

He's a terrific imager, a good neuroscientist, put together a powerful story about how mindfulness, if done in the eight-week protocol, prescribed originally by John Kabat-Zinn and then refined over the years, and do randomized blinded trials with ends that are larger than five, so that you're getting … Since you can get some real results, show something very powerful.

Solid regular mindfulness training under those conditions boosts executive function and lowers depression rates in pediatric populations, in adolescent populations and in adults. No kidding. The second, if the first thing is become aerobically fit, the second thing in my new high school if the gym is the center, I'm going to have some mindfulness rooms.

We're going to have some places where you can go and will actively be practiced. It's the first thing the kid is going to get because the transition from a home to school is

extraordinarily traumatic for most students. They've often have a, especially it was teenagers, they've often have a fight with their parents and they don't have good mental time travel, so of course they didn't prepare for tomorrow's test and didn't put the backpack together.

They come out of a fair, often fairly hostile environment, even though, even if it's loving. After they go to a school, well, guess what? They're going to confront a bunch of other immature people with no mental time travel who are risk-averse and are probably emotionally not particularly competent towards man.

We'll start that day by God with mindfulness in the David Creswell, John Kabat configuration, and have them be tested for it. Because, that has been shown to both aid and abet executive function. Get them into the gym and then they can do their precalculus.

Dave: That would be a complete change of what happens in schools. That, there's the long answer to that question, "How do you reduce suffering in teenagers?" What about the role of maybe not having raisin brand for breakfast?

John: You should never even bread under any circumstances.

Dave: I absolutely agree with you there.

John: I'll take the lawsuit. Okay. Because-

Dave: At least we didn't identify the brand of it there. That's just an example for high-carb, sugary breakfast of any flavor, whether it's a pop tart or a doughnut or a fruit smoothie even.

John: Yeah.

Dave: Where does food come into this for kids and teenagers?

John: Here, the literature is really sloppy. I'll just be blunt. Not that I don't believe it. In fact, the only literature that I've seen, and it had to undergo a statistical review about a year ago, and it's the Mediterranean diet that I'm talking about.

Dave: Okay.

John: It got root canaled. When they come back and they settled the statistics down, actually they still had a strong result. I use it as an example because, though I believe deeply in the importance of nutrition and fuel and whatnot, it has received so little funding and the confounding variables are so strong yet everybody's individual metabolic rate, their ability to make ghrelins and orexins and leptins, those are all genetically controlled.

The gut's got a big, gigantic set of nerves down there that's constantly squawking to various parts of the brain. We know almost nothing about it. On top of all that, you've

got a bunch of microbiota and bacteria and viruses and even a few fungi that are sitting around throwing lots of different chemicals, having to respond to the system, and everybody's got a different microbiota because they actually eat different things and they didn't all choose their parents wisely. Tell me that I can do good science, and they'd announce maybe you, "No, we're just starting."

Dave: Have you heard of one of your other colleagues in Seattle, Naveen Jain? He's running Viome. You have chatted with him?

John: No, not at all. I'm familiar with it.

Dave: You know. Okay. That is one of the things that gives me great hope for understanding what's going on in the gut. Because, at least now we have a list of all the bacteria, viruses, fungi, and phages going on in the gut. Maybe if you have the data, you could start understanding behaviors but the links between those and the literally billions of potential paths between that and the behavior. I think it's going to require a bit more compute power than we have now, but we're going to get there in our lifetimes.

John: Absolutely. I'm absolutely convinced, but you put your finger on the correct parts I think. I love the approach of Viome and other people that say, "Okay, first we need a population census," which is what they do. What types of bacteria? What types of normal flora are there? What types of [magravates 00:31:06]?

It's so powerful. That, the ability to look at how that interacts with neurons is a big whole deal. Usually, bacteria are walled off from the brain, which is where most people look at with the central nervous system, but it's not like they're not trying to get in. There's lots of tasty fats and stuff you can get at.

Until we've got the population down and then start asking questions, we're going to overlay that now with it, somebody's individual genetic profile. Because, it's going to be different from one person to the next. How does this configuration, this cluster of normal flora, interact with this genetic metabolic profile? How does that create X, Y and Z?

None of those tables have been done yet. They're in the process of being done. Until they're done, my best advice when I talk to people about this, Dave, is I just say, "I'm a fruits and vegetables guy." You just going to have start doing that. If you're going to have white meat, you're going to have meat, make sure that it's chicken. If you're going to have oil, make sure that there's some olive in it.

Dave: Got it. Pretty simple on the nutritional side. Why chicken versus grass-fed beef or salmon?

John: Well, salmon you might be able to make a strong argument depending on the collection of heavy metals that it isn't [inaudible 00:32:18].

Dave: Yeah, sockeye salmon for the low metals of course.

John: Yeah, yeah, yeah. Exactly. Exactly right. Yeah. Stay away from tuna and you're going to be a happy man. I don't have anything. I don't have to answer your question. I don't have much to say in the peer review yet. Until I do, all I can do is give an opinion.

Dave: Got it. Okay. It isn't necessarily research-based but there's definitely pros and cons for both of those and I've certainly written all my opinions and all the research I can find on the nutritional front. I always like to talk to brain doctors and brain researchers about, "What do you do?"

What about cognitive enhancers? I mean, I was well known for, well, and I think the first big name to just publicly say, I took modafinil for eight years and it saved my meditation, saved my career, it made me a better human being, but I don't need it anymore. Because, my brain just works like that all the time.

That's the extreme end but there's a bunch of other cognitive enhancers, caffeine, nicotine, smart drugs, nutrients. What's your take on those?

John: Well, it's such a broad question that I'm going to ask you to specify.

Dave: All right. Is there a role for nootropics for either adults or even teenagers to make the brain work better, grow better, live longer?

John: Not necessarily.

Dave: Okay.

John: There's evidence to suggest there are certain enhancements that occur in the short-term. We know very little about what happens 20 years later.

Dave: That is very true.

John: Given that the, particularly for teenagers, the amount of developmental sequencing that's going on in the highways between prefrontals and amygdala are so delicate and for the most part so unknown. The little that we do know suggests you can really screw it up psychotropically if you're not careful.

The data are so limited that they say anything evidence-based would not only be irresponsible, it would be potentially hazardous. Since, in my career, I worked with psychiatric disorders, my big thesis statement is do no harm.

Dave: Well, I just, I got to say thank you for pointing that out. I have been religious about telling people. Because, teenagers, the long-term, even young adults in their early 20s, that the long-term consequence right there. Don't go out there and start taking modafinil and all these other smart drugs because your 19, you want to do better in school.

Your brain's not done cooking. Let it finish before you start doing some of this. If you want to enhance your mind or counter a function, do that at every age, which is nootropic. If you have a mitochondrial, even slight decline, you don't think as well. You can do that. You can eat really well. You can aerobically be safe.

John: That's right.

Dave: You can meditate. Don't go hit the smart drugs. It's not for young adults. It's for brains that are done. Anyway, don't fight. Thank you for saying that in so many words because-

John: That's okay.

Dave: It's really important and that also, I believe anyway, goes. Even things like micro-dosing LSD or using iowaska and things like that, those are not a young person's thing. Because, your brain is still doing what it's supposed to do without them.

John: Well, I usually use as the metaphor, asbestos.

Dave: Yeah.

John: Because, asbestos, when you smell it, it is a trap door that will not spring for almost 25 years. Once it springs, you're dead. There's no cure for it. There's no getting away from the lung damage that will happen. It is very impossible because the brain is so much more complicated than lung structure.

That, these very powerful drugs which were never built to be what, in the concentrations we're giving them certainly. That's true with any pharmaceutical that comes out of a natural plant. It was built to be within the plant itself and so you have to ingest fully. Even that ingest fully, you're actually ingesting an entire ecosystem into your brain.

Dave: Yeah.

John: We know so little about it that, Dave, it's just … and there's some things we do that we, "Get off your butt and go for a run." It's [inaudible 00:35:57] to say your mitochondria. It just is.

Dave: Yep.

John: Focusing on that until the research is better developed, I have no dog in this race. I don't really care. If it works, as a scientist, I long since quit caring what I believe. I just would like to know what's out there.

If I don't know what's out there, because I only have one brain and most of them are not … nerves are not mitotically active anymore, it does not behoove me. Given, it's how I have to make my living on my brain. Most of the millennials will too, Dave. They will

actually have to … Since we're so moved into an information economy, you cannot afford to take a risk with it in a fashion that is irresponsible.

Like I say, if it worked, terrific. I wouldn't mind doing that all. I live in Seattle. We're going coffee.

Dave: There you go. There might be some evidence for coffee, and-

John: Actually, there's pretty good evidence.

Dave: I just interviewed a researcher from Vanderbilt who wrote the first paper in 1988 about using nicotine, not tobacco but just nicotine. Even for Alzheimer's and things like that, there's some evidence for those things, but don't do that if you're 18. It's just not right.

When I was 18, I would've said, "Screw you, Dave. I'm going to go do it. I'm just telling you, you're talking to John Medina here, who studied this stuff even more than I have." It's not a good idea. You'll have more power when you're older …

John: That's right.

Dave: … if you listen to that advice.

John: Okay. That's right.

Dave: All right.

John: Yeah.

Dave: Let's move out from the childhood development and the teenage … Actually, I got one more childhood question for you.

John: Okay.

Dave: Then, we're going to move past teenage into the young adult and then the aging brain is where I want to end up.

John: Okay.

Dave: What is the role of early childhood trauma and what's going on in the brain?

John: Well, we're getting a master cause in it in the United States currently.

Dave: Yes.

John: Germany had it before with the Syrian refugees, a certain population were pregnant. This will be the great work of Meghan Gunnar. Are you familiar with Meghan's work at all? Because, she's-

Dave: Surprisingly, not. I've done a lot of work on childhood trauma. That's a big part of the 40 years something I do. Okay?

John: G-U-N-N-A-R, want to start looking her up. You get it?

Dave: Okay.

John: Megan, M-E-G-H-A-N. Look particularly at her work she did with Simon Fraser. She's at the University of Minnesota and she's American.

Dave: I know Simon Fraser's work. Okay.

John: Simon Fraser's work with … This will be the stuff I know you've heard of, and that is the Romanian orphans work. She's done actually much more than that. If we can start to get now into epigenetic land for a little bit, which we could-

Dave: For the people listening, epigenetics is the science of having environment around you changes your genetic expression and it's one of the reasons bio-hacking works as a field.

John: Exactly right. The seminal finding, here's … I can get emotional with this pretty quickly so I'm going to need to settle down for a second. Because, the data are so clear and the damage is so apparent.

We know, with stress systems in the brain, you generally have one of two giant field offices to work with. One of them is called the HPA Axis. H stands for hypothalamus. P stands for pituitary hypothalamic. The A stands for adrenals. The seminal hormone for it is cortisol.

There is another though, a stress response you can give. Some people start, they lead they get stressed, they lead with cortisol.

Dave: Yeah.

John: Not everybody thinks so. Some lead with the other big huge arm and that is the SAM, Sympathetic Adrenal Medullary. Its big hormone is epinephrine, except if you're in the UK, in which case, you'll call it adrenaline.

Dave: Right.

John: It's the … It's still the same thing. Okay. If cortisol is supposed to be high in the morning and low in the evening. That's its job. Its job is to regulate the high and low. If you have a stressed womb, the seminal finding is that cortisol can leach into the placenta, go into the developing brain, probably the hypothalamus, although that's still … That's where the shadow still lies.

Dave: You said in the womb. This is prenatal trauma that I want everyone to hear that. Stan Graf has been on the show talking about this as well but like everyone say like it matters, like be nice to pregnant woman. All right, keep going.

John: It totally does or better to say, allow them the goldilocks stress that they're supposed to have because you need a little bit of stress to spike it so one can develop normally, but what they're not supposed to do is be a stoned with barrel bombs or if they're pregnant, watch their eldest son be taken away from them for two years and never know if you're going to get him back. The kinds of stress, the catastrophic stress is beyond the goldilocks effect.

Now you're switched over into epigenetic land because with sufficient concentration of cortisol slipping right into the placenta, goes right into that baby's brain and rewires its stress responses, such that when that baby is born that baby is now under a permanent state of alert. Cortisol which is supposed to be high in the morning and low in the evening is high in the morning. It's high in the afternoon. It's high in the evening. It's high all the time. These kids are on a permanent state of high alert.

Dave: I was born that way. I was born with a cord wrapped around my neck, had a birth-related trauma and I dealt with all that stuff. It is fixable but, man, it is a lot of work. In the first 30 years of my life, I didn't know I was in that chronic alert state because it feels normal, so yeah I love what you're saying here.

John: Megan Gunner has done a lot of the behavioral work to get to some of the point with Simon Fraser and others because there's behavioral consequences to that that you can see the risk of pediatric anxiety and depressive disorders is sky high from a traumatized womb. The ability to navigate your social environment and not feel stressed about it is pretty low. You're going to be stressed a lot of your life in such fashion that when you get married you can actually have a stressed marriage.

That stressed marriage is going to be the same damn thing and put the cortisol back in the placenta. Even though it's totally epigenetic, there is a Mendelian inheritance around. It's simply that the cortisol gets passed from one generation to the next. The kinds of babies we are creating in south Texas even as we speak and New York Times uses the word horrific and I would call that a light adjective.

Dave: I agree. We saw this in World War II as well and you can see it echoed down through the generation. I've seen it in my family. I've seen it at some people in Europe. We know that this is what happens, yet it still happens.

John: There's been some studies done in El Salvador. Remember during the civil war there was [inaudible 00:42:34]. One of the interesting things about the German refugees now in Bavaria is that it's a perfect experimental paradigm because it actually has a start stop date that you can know that you had Syria that was in a fairly stable social structure for a period of time and then all of a sudden the barrel bombs start falling.

Then they had to leave, so the stress, the inset of the stress can be known, inset of the stress can be known immediately. If they survived, you'll have a trace record. Okay, they went to Turkey or they crossed the Mediterranean and they were in Italy and then finally in Munich. You can know every bit of those things. You can do a fairly robust set of behavioral work simply because the environmental circumstances are still well known.

Dave: Is there something to be done there? A lot of people are saying, "This describes my family. This describes me. This describes my kids," what is there to be done about this?

John: Want to specify or just in general?

Dave: Just a general thing. Some of us since going, "God, I screwed my kids," or, "My parents screwed me up," so that can turn on that guilt and shame we just talked about but are there things that you can do as an adult either for yourself or for your kids so it doesn't keep happening?

John: Absolutely. There's a lot of hope here mostly because one of the great powers of the brain is the ability for it to rewire itself and to adapt, and actually it's a form of reinvention. In fact, I usually say the brain is hardwired not to be hardwired. If I were to give a metaphor, I would say it's not a classically tray and chaliced, it's Charlie Parker.

Dave: Jazz.

John: [inaudible 00:44:11] It can move but it's still beautiful and it's still extremely intelligent but man cannot adapt and I guess that would be the way to say it. There's a couple of ways to control the adaptation. Shall we go down one of these roads?

Dave: Yes, let's talk about that.

John: Now, we're going to be talking now … we can stay with teenagers but for young adults as well and then maybe in your 20s when you're starting to have kids. There is a phenomenal statistical congruence that occurred number of years ago. I've had the great fortune to have a ring side seat to at least one of them. This is a canonical work of totally behavioral work … she's a psychologist, Diana Baumrind who did her work in the mid '60s on what a good parent looks like.

John Gavin who essentially did the same work in the late '90s and they came up with the exact same findings. I remain, my job's still … behavioral job's still dropping a little bit from what they came up with because there's such hope in what they came up with to our point here. Diana Baumrind and John were first able to show that all of parenting rises or falls on a single battlefield. Like I say now, Diana's done her work in Berkeley, John did his work up in Seattle but John's PhD is in applied mathematics by the way. He's not a psychologist so he approaches it in a quantitative fashion that grumpy bioengineers like we're actually really a buyer.

If you can come to the same conclusion, all of parenting rises and falls in a single battlefield that you're going to hear this. What you do when your kid's emotions run hot, when they're intense, now hot doesn't just mean negative like fear and anger. It can also mean joyous or happy or completely perplexed by something but it's hot but what you do when your kid's emotions run hot directly predicts suddenly turnout 20 year later so-

Dave: Pepper spray is the wrong approach. I think we're out of time.

John: Yeah, maybe solitary confinement would like slamming the doors like what. Okay, so what do people do? Then Diana asked this question. She said it's odd think that because we thought there'd be so much variance in this data that you couldn't get at anything, what does a good child look like in North America? That's a question you can ask and no one's going to agree because there's so many cultural variables. There're so … It turns out that would be the case.

Most of us agree on what a good kid looks like oddly enough and there're simple things like I don't want them to grow up to be a serial killer. I don't want them … I would love for them to be happy. In my household, I want them to stay curious. Those kinds of things but there's a fair amount of agreement on what a good kid looks like. Diana was able to show that parenting behaviors cluster statistically just like genes on a linear piece of chromosome which is why I have a natural affinity. Be careful because I also have a conformation bias, so watch out.

Dave: Okay.

John: He was going to get side tracked in his profession for a second so we need to be careful. Four clusters of behaviors at those segregated families. Only one of those behaviors give you the powerful kid that everybody wants but they're fairly easy things to do which is why there's a lot of hope in it. It's the ability to react to a particular behavior that does it. Shall we go down this track for a second?

Dave: Yes. I think everyone listening will benefit from this.

John: All right. Let's do John's work because his is the most recent. Diana by the way calls the gold stand of the parent you want to be, authoritative parenting. That's what it's called. Because it's a mixture of really being hard ass with your rules and at the same time being extraordinarily loving and available and open and kind even with what you see as a parent, so four, four statistical clusters. Here's what you should not do.

We're going to start with the battlefield. The battlefield, remember, is the kid has an intense emotion. On this case let's pretend there's a daughter, Emily who has a goldfish that's just died. Emily's three and so this was an intense emotion. It's her first real experience with grief because she's known this goldfish forever. Now the goldfish is dead and she's coming to you crying. What do North American parents do?

They do one of four things. Here's the things number one. This, John calls dismissing parenting. You say to Emily, "Emily, I see that your goldfish has died and now I see you crying but this is no big deal Emily. We're going to go to Petco tomorrow and get you another goldfish, so you just grow on and play." The reason why John and Diana would call that toxic is because Emily's got this big feeling of grief. She says, "This is not supposed to be a big deal but it is a big deal. What am I supposed to do with this?"

There's no tools to be doing it at all and so she tries anesthetize which is why John calls it dismissing parenting. It's a good term. The second … and there's a behavioral cluster. It isn't just that behavior but several that post segregate, okay? Like I said, these are evidence based research efforts. Number two, he calls it disapproving. It's a lot like dismissing. Emily comes to you and says, "My goldfish has died. What am I going to do?"

You as you're a disapproving parent, that's the second cluster, you say to Emily, "Emily, this is no big deal. Circle of life, things die all the time and they're reborn. This is not a big deal. We'll go to Petco and we'll get you another. Now stop your crying. Emily, be a man." That's just like dismissing, only now you've taken a rock and thrown it at her because it's pejorative. There is a … and what Emily does is, "This is not supposed to be a big deal then why do I have such a big feeling and I'm not supposed to experience this big feeling. There must be something wrong with me."

Dave: Yeah.

John: The relationship that they have with big feelings becomes one of suspect and suspicion that somehow this big feeling was wrong in some form and you shouldn't have those. There's only certain approved feelings in my family also that unbelievably toxic. Number three though is the worst. This is the one that's got the highest rate of psychopathologies and all those associated with it. It's called laissez faire parenting.

The best example I can think of is one from a case study that there was this woman who we gave her that Emily that story and said, "What would you do?" She said something extraordinary, Dave. She looks up and she says, "I hate it when pets die. I would go for a run."

Dave: Whoa and just not even deal with your child, wow.

John: It's not in the picture. In fact, mom's out the door because she can't handle her own issue. That's called laissez faire parenting style. That's the most toxic because it's a controlled abdication of the parenting position. You no longer have any inquiry or you're trying not to have any input. When there's something that's real big that's a big deal, you are teaching the kid, it's called passive transfer, you're teaching the kid to run away from the problems. That's what happens.

Only one, John calls it emotion coaching. Diana calls it authoritative parenting. That cluster of behaviors produces the most psychiatrically healthy, the most stable, the most productive, the best executive function, yup, we can bring all that back now, that exists almost anywhere. What's fascinating about emotion coaching or authoritative

parenting is that it has very strict rules but it is unbelievably kind and it almost always leads with empathy before the rule is inserted.

What you would have to do and often when there's a big feeling, not only is there empathy, there's also a teaching moment because you're starting to teach the kid how to deal with certain feelings. In our example with Emily, what you would do with Emily, "My goldfish died"? If you're an authoritative parent, if you are emotion coaching parent you would say, "It's awful when things you love die. Come here. I want to give you a hug because you and I Emily are going to cry together."

"Emily, I want to teach you something about grief. Grief is a lot like you standing on a beach, and a tide is coming in and out. Because that tide is going to hit you and you're going to feel these awful feelings but you know what's going to happen, Emily? They're going to go away from you that the tide will recede. For a while you'll feel better but you know what? If you really love something, it's going to be coming right back at you and it's going to hit you again."

"Back and forth this will go. Emily, I want to make a deal with you. Every time that tide hits you, I want you to find me and I will hug you and we will cry together." That's what you do, David.

Dave: That is powerful.

John: It is also not an opinion.

Dave: Based on data.

John: [crosstalk 00:53:04] about that.

Dave: I remember when my daughter … by the way, my son's throwing his paper airplane at me during the interview which is awesome, "Allen, give it a throw."

John: That's perfect. Bring him on.

Dave: He'll come down if he wants to. He's in the loft. I remember my daughter was about five. She was really upset about something and she's-

John: She's 11 year old now?

Dave: She's 11 now. She didn't know what the feeling was but she felt something, so I said, "This is awesome. You're having an emotion. We'll figure out what it is. What does it feel like?" "Where's in your body," and when we got home, so it's a drive, so I said, "Draw a picture of it." All of a sudden it became this, "I'm just going to look at this." It was the coolest thing. She do this red ball with the black line on it but just the idea of just recognizing it which isn't necessarily what I always learned.

Just I would say sure all parents make lots of mistakes but generally, that seems like really good advice and that's the growth that you'd get as a parent is realizing now, "I probably could handle that differently."

John: It's the whole, the whole reason I'm going through all of this is that you only have to practice what I just said, the authoritative parenting, emotion coaching parenting 30% of the time in your interactions to get the benefit. The other 70%, you can go back to your old nasty habits, do your old stuff.

Dave: That is some serious hope for parents right there, perfection not required.

John: Exactly right. In fact, I would argue that perfection would be your enemy because if the idea is described to get some of these more sophisticated behaviors correct, it's going to ding you every time you feel guilty for not doing it as opposed to feeling there could be some hope. We have to practice our own medicine here now. Empathy is a fragile delicate thing for people to do. If you only have to do it 30% of the time, even parents that really suck, Dave, can do that.

Dave: Now, what about the rules? You said it's authoritative … Where do the rules come in here?

John: Man, that's actually a very important part of both Diana's work and John's work. That's why she calls it authoritative parenting, you set your rules in titanium but the rules that are a lot like rules that are like banks on a river. The banks on a river is the rule of the river if you think about it, right? It's the one that makes you flow and you'd guide it and what not but rules in Diana hopelessly makes this metaphor we may keep consistent, don't put rocks in the river.

Make them on the sides but the rules, those banks are inviolable. I can give you a really good example where my son, Joshua. This is a Josh and Noah approved story. I had to go through all of these to make sure. Okay. Josh is five and Noah is three I think at the time. They have a great relationship but sometimes they could become physically or they would get into pillow fights and then sometimes the pillow fights would devolve.

Dave: Right.

John: I heard this upstairs. They were downstairs having this pillow fights. It was getting pretty wild so I came down there almost immediately. Josh was getting out of control. I physically separated the two of them and Josh bit my hand. He got a major timeout because I told him this rule. It's a rule that's in our household. You are allowed to be angry. Quite frankly, Dave, Josh deserved it. Noah didn't deserve that but he was not being nice to his kid brother.

You are allowed to be angry. You are not allowed to express it violently. That's a rule in our household and that has never varied. That's what authoritative parenting is. Interestingly enough, you can add something that's also now called … this is a different research throughout but it ends up being quite congruent, something that's called

inductive parenting whereby it's a parent's relationship to their own rules. Here's that relationship.

The relationship is you have to explain yourself, explain your rules. For example … You can show … This was done by measuring compliance rates. If you just say, "Don't touch the dog," because the dog is there, what's the compliance rate on the kid? Sometimes it's a 100% but sometimes it's 30.

Dave: Right, right.

John: If you want to double that, you want to get it to 60 and have it a much more stable number. Just add a sentence after that, "Don't touch the dog because the dog bites and I don't want your hand to get hurt, to get injured." When you begin to explain your rules, the compliance rates go up. More importantly it gives a round for negotiation because the other thing about authoritative parenting, Dave, is that even though the rules are set in titanium, they're regularly heated up and reformed.

The banks are regularly shifting because as the kid grows, they require different rules. If you have both a sense of being very strong by keeping your eye out all the time that you may have to change it, it's much easier to do if you are routinely explaining the rationale for your rules. When that rationale no longer applies, the rule can evaporate.

Dave: Beautiful.

John: Yeah.

Dave: Now, let's fast forward. We've talked about young adults. We've talked about teenagers. We've talked about kids, babies, prenatal. What about those of us in the 40, 50, 60, 120 thing, what do we do for our brains?

John: Yes. Now there's the whole brain rules raging well that it's probably if the question is how to transit through the aging process well, we should probably define a few terms. The first one is going to be longevity and the other one is going to be life expectancy because in the research world they're two very different.

Dave: Yeah.

John: That's right. The amount of time you can spend on the planet or conditions ideal is the definition of longevity. That's what we think is longevity. Life expectancy is sometimes called lifespan is the amount of time you can spend on the planet given that conditions are not ideal. That's going to be one that is if you think about it for a second is going to be primarily a nature component and the other one is going to be a nurture component.

The question is how stable are those and what can you do to transit through whatever longevity you have? We actually don't know the longevity number for humans now. We're not sure how elastic it is. We know that the-

Dave: I'll found out. I'm totally good with that.

John: You're the man, bro. We don't know but we'd like to or really we were awarded the noble price with [Tilinders 00:59:27] but that's about as far as it's gone.

Dave: Yeah.

John: We will get there. I have a feeling that there's a … particularly like people my age are baby boomers and you're probably a little younger than I am but the strong sense with all of the study committees and they'll say, "Yeah. We're going to fund that. We're going to fund that. We're going to fund that thing," are really going to know.

Dave: Yeah.

John: Right now, the upper limit is depending on the laboratory you're looking at for longevity, for how many longevity is either 115 years or 120 years or x mark, mark x to infinity that we don't know. You can take your pick right now.

Dave: My number, I'm taking 120, I'm adding 50% because we have about a hundred more years of technology to grow before then so I'm just spanning out but really that's why my 180 plus number is something that I think is reasonable but not with what we know today.

John: Sure because we don't know that now. We don't know that. We don't know if people are into 180.

Dave: Yeah.

John: We don't know why most, why the upper limit, only one person we've ever, that's been verified has lived until 122. That's an end of one. If we put on our statistical grumpy hats for a second, that's not science.

Dave: We showed it's possible and a lot goes to teach it.

John: It's a case study with a flashlight and that's good. That's good enough. That's how science actually is done, look at the case study and then try to explain it, so fair enough. All right, so though the effort in the book was given us how, we're not sure what the longevity is but it could be a lot longer than the 78.8 years of it currently is for most people. By that, I mean their lifespan.

Dave: That's embarrassingly crappy by the way. We can do better. I just to get say that I think, right, keep-

John: I think we probably can and the book actually ask the question what can you do to transit through the aging process better that would allow your lifespan and your longevity numbers to equal each other? There are probably five sets of things that you can do and not all of them are particularly obvious.

Dave: Yes.

John: I went through the book to talk about I start with, of the fact that if you have lots of friends and you're constantly socializing in such fashion that you're continually being exposed to alternate points of view, in fact you can show ... This is the most remarkable statistic in the book, David, because you can get a 600% increase in episodic memory scores which is an unheard of number. It's this Dennis Park lab. If you do the following, you regularly engage in arguments with people who do not agree with you but who remain your friend.

There's two things that you can actually call it productive engagement versus passive engagement. Productive engagement is the spice but if you're friends. The metaphor, a good metaphor would be in the Supreme Court of the United States, there was Antonin Scalia who was a conservative judge who died. His bête noire, at least his opposite person on the liberal side is Ruth Allen Ginsburg. Ginsburg and … they've never agreed on anything politically, yet they were the best of friends.

They went to Oprah together. They liked each other. Their spouses liked each other. She gave a eulogy at his funeral saying how much he meant to her. They agreed on nothing. They had a tremendous productive engagement but that ability to regularly exercise your point of view in the face of scolding disagreement but with which friendship changes your episodic memory score. That's a form of socialization.

That's the thing going to five. Two, read books 3.5 hours of reading per week minimum, more if you can get it. If you do, you can get, you are 17% less likely to die at a certain age depending on what your actual aerial tables are and how well you chose your parents.

Dave: Does it matter what you're reading?

John: It appears to be the best is to read fiction by people who know their way around a paragraph.

Dave: Well written stuff.

John: Yeah, so nothing wrong with Danielle Steel but she pales in comparison to Hilary Mantel, and both to William Faulkner, those things where you are actively engaging in people that can really get you in another world.

Dave: Do we have data? I've talked to a lot of people who have switched to audio books, some of them because of MacBook generation, sometimes just because they're doing other things. Is listening, is it likely to be the same?

John: It totally depends on what the words do to you. Let's introduce a term that we talked about I think probably 45 minutes ago now, virtual transposition. Virtual transposition turns out to be magic fairy dust for the brain. When you are reading a book, when I read

William Faulkner like I've just finished reading Light in August for the third time, the Light in August can put you into a world unlike any I have ever experienced in my life.

I am virtually transposed into it. When you start to read, you start to visualize the world that you're in and you start to see that. The more you can visualize that, the more your virtually transpose yourself the better it is for the brain. That's the cognitive secret sauce. If you can do that with auditory books, terrific. If you need to have dead trees in front of you, fine. What if not, that's not the point.

Dave: Got it.

John: The point is what you can have, Dave, is the image. I say this as a form of professional animator. You have to generate the image. You have to do the work. You have to generate the image yourself.

Dave: Even this format as a podcast, people are building pictures right now of what you look like. They can go to YouTube and they can look at it but I stop doing video on YouTube because most people, I'll do five minute teasers or I'll take out the very best bits but it takes a lot of work to do video and I think people get less from it.

John: I love the fact that there are still radio dramas out there because it forces you to virtually transpose. I'm convinced that's one of the reasons why podcasts that have a narrative thread to them like the one podcast that was … I forgot the name of it but you probably know it. It was investigating a crime and it turns out [inaudible 01:05:20] about whether the guy did it or not. I am sure that the name will come to me in [inaudible 01:05:25], that one.

When you read, when you hear that, you are virtually transposed into that entire relational thicket that they described. It's just like reading a book. That's the stuff that appears to keep your brain buffered against the negative effects of Alzheimer's and probably it taps down enough of the cortisol levels because you're not into your own problems. You're into somebody else's and that tends to lower people, so that you're going to change cardiovascular insults. There's a lot of physiology.

Dave: Now you inspire me. I have to write a fiction book now just to help people age less, all right. I'll put it on my list.

John: Use this your own model, Will Hall.

Dave: There you go.

John: Okay, so that's the second thing. The third thing you can do which I think is interesting in its own right it is, exposure to music particular and this once again is in the pure good work, as with all books that are right, the Grand Factory Flairs and is available and there's a lot of mythology about music. For example, the relationship between music and mathematical competency is tenuous the best. We don't really know but we do

know what music does to involve your longevity and mostly importantly your executive function. No kidding.

Let's go right back to this. When you get older, your executive function tends to die off. You start to … things are breaking down and it's painful and you can't ignore those anymore, and so your impulse control is starting to descent to start to centralize to your own problems. That's maybe a normal part of aging but if you play a musical instrument and this was done by people who have knowledge of playing the piano and have no knowledge of music theory.

For four months, they hit the Carnegie Mellon or the Carnegie Hall or take your pick of the music that they have to learn. They were in a class and they were learning piano, their executive function just soured. Their impulse control improved. Their cognitive control which is the heuristic of just the detail as well as the ability to attend to a particular stimulus, all of those things improved.

The third thing I suggest is if you really … Because executive function, impulse control, that's a measure of stress management which is going to directly affect your heart, which is going to directly affect how long you can live here, yup. Learning to play an instrument you have never seen before is good for longevity, maybe better to say lifespan. That's the thing.

Dave: Incredible.

John: Fourth, we talked about it, so let's not belabor it but it's aerobic exercise. Strengthen is good too but it's amazing how little you have to do to actually get a cognitive benefit in elderly populations. Thirty minutes of moderate aerobic activity five times a week, moderate being walking too fast to sing, so it's like in the [Sarangani 01:08:15] we'll walk in 20 kilometers a day so this makes all sense. You want to get back to that.

The fifth thing to me is the most interesting one though. This is the most magical because it feels just like the movie, Cocoon. Have you ever seen the movie, Cocoon?

Dave: Yes, of course.

John: Yeah, yeah. Okay, so we're not going to work with Don Ameche or Ron Howard. We're going to work with Ellen Langer. Ellen Langer was the first woman to get tenure in the psych department in Harvard, and she's a legend. She's done a lot of really cool stuff. She created … have you ever heard of the counterclockwise experiment before? Are you familiar with this at all?

Dave: I'm not.

John: Let's get into it. The question you could ask because she does a couple of different things based upon … What she's going to do is she's going to ask the question, "Is there any power in nostalgic re-exposure?" It turns out … There are three reasons she went after what's called the counterclockwise experiment and I need to briefly review those

before I can talk about the [inaudible 01:09:14] clockwise. This will take us a couple minutes.

First of all, she has noticed for a long time that there's a retrieval bias in elderly populations. If you ask the question, you do, gross domestic product over everything you remember, you'll remember best both the quantity of information and the temporal order in which they occurred best between everything that happened to you between the ages of 15 and 29. That's what you'll remember when your life is over or when your life is in 70s and 80s, and that is you've done more of your life than what you're going to have left.

There's a retrieval bias. You remember things much better. Number two, when you start reminiscing particularly over the ages of 15 to 29, your social connected scores go up which is interesting, there's no way prior for this. Your eudemonic wellbeing increases so your risk of suicide is going to go down. You become less afraid of dying, and here's the most interesting thing. The more you expose yourself to your own nostalgia, the greater tolerance you have for outsiders particularly with people that have perceived social differences.

We think we even know the reason why and here's the biggie. When you become nostalgic, your dopaminergic system comes right online. It's been declining for a while when you're again but what I call the highway to hell between the nucleus accumbens and the ventral tegmental area, those dopaminergic did just comes online and all of a sudden dopamine is flooding through. On the basis of that she said, "What if I did this experiment? What if I recreated and took a bunch 70 year olds and recreated the reminiscing?"

"I'm going to have to run at a monastery and I'm going to turn it into 1959," which is the [inaudible 01:10:57]. They were not allowed. The cohort was coming. She does a … it's going to be a pre post experiment. We're going to measure cognitive ability and motor skills on a wide variety of things pre and then they're going to take a bus from Cambridge and go west to this monastery. It's not a monastery anymore.

You can rent it out but she prepped it to look like 1959. All the close circuit television has President Eisenhower is going to be United States version of 1959. You're going to have Johnny Unitas of the Baltimore Colts that is the Minneapolis Lakers, not the Los Angeles Lakers. You're going to have newsfeeds and movies at night. When those people got into the monastery, if they couldn't carry their suitcases up the stairs, tough, they had to open the suitcases and bring the shirts up one at a time in that room because they're no longer going to be 70 and 80 years old.

For a solid week, she exposes them to 1959. They ate the same foods, had the same smells of blah-blah-blah-blah-blah-blah and at the end found what I can only … it gives me goose bumps when I think about it. It was actually written about the New York Times a couple of years ago and it's called that counterclockwise experiment. What she showed is that hearing sensitivity began to improve.

By the time it was done, hearing sensitivity have dramatically improved. Memory scores and processing speed scores improved. Particularly a very wickedly hard test called the digital symbol essay, I'm not sure if you ever heard it where it measures both processing speed and memories, really tough and it improved. Near point vision improved. Manual dexterity and whole body dexterity improved and their feet, it's got longer.

The reason why is that they're stretching them now because they are more motor active and so those things are starting to … by the time it was done, there is actually a video and this is what was written up in the New York Times of they're waiting for the bus to go back to Cambridge, one guy had thrown his crutch and they had started to play a game, a touch football where so many [inaudible 01:12:53].

The power of dopamine and it's the fifth thing to say about what you should do. You should go to your room and create nostalgia of whatever your reminiscence bump is calculated to be between the ages of 15 and 29, and you dose it like you took a pill. You regularly get in that room and you listen to the music of between 15 and 29. Eat those foods, read those books continually and squints in the whole idea so that you can have a dopaminergic spike that can occur and there's no alkaloid inside.

Dave: That is awesome and that is something that in 500 plus episodes no one has ever talked about. That is really cool.

John: I encourage all of your readers to look up Ellen Langer is her name, L-A-N-G-E-R, counterclockwise experiment. If you want to get, just get a clipped out version, go to the New York Times article on the counterclockwise.

Dave: All right, I will link to that in the blog piece tied to this episode.

John: For sure.

Dave: Now, one final question for you, John.

John: Sure.

Dave: You might have already answered some points to this but I want you to prioritize the answers here. If someone came to you tomorrow and said, "John, I want to perform better at everything I do as a human being, just throughout everything. Three most important piece of advice," what would you offer them? Just three.

John: Okay. Number one, get curious. If your brain has gone to sleep, figure out what used to make you interested in life and you become reacquainted with it and you shake hands with it and you do it. There's something underneath that you have to do. A lot of people have been working in the grind stone all their lives. They've been doing a job they hate and they live for the weekends and all that. There's a fair number of people who do that.

Their curiosity is gone. No. You have to spend some time in what I like to call the glittering caves land, glittering caves where there might be jewels. You don't know what those are. My God if you've become arthritic intellectually, first thing, number one is that you have to become curious. Number two, you have to start living from the benefit of others.

Dave: Amen.

John: You have to start getting into other people's perspectives. You have to start finding what their alleys are and doing your best to dissenter yourself so that you are not constantly seeing your own needs and your own priorities, and your own wants and desires but you are looking at the needs and wants and desires of somebody else. This has strong empirical support in the work of Marty Seligman, the old [inaudible 01:15:27] this guy who is talking about permanent unhappiness and finding your happiness at points and all of that.

The second thing is that you're constantly getting … That could be involved in getting into a charity. If you haven't gone out and picket at something for 40 years, it's time to paint this new sign and go out there. There's plenty of stuff to do. The second thing is that you need to get inside other … Number third, number three, I would imagine I'm just going to call lifestyle custodial hygiene.

That involves mostly getting enough exercise so that you can sleep well. Those two, the inability to get … to be sedentary and the inability … we didn't talk about sleep at all, I know there's no time for it but it has an unbelievable effect on the quality of life for virtually everything else you do.

Dave: It does.

John: Even those a lot sounds pedestrian, exercising and sleeping well is probably my third and final answer to your question.

Dave: Beautiful. Dr. John Medina, what a fantastic interview, so much we covered, so much knowledge. I think that we're going to find people listening to this episode more than once in taking notes. Of course, that they could always get the transcript online but taking notes has its own set of value for making newer things.

John: It sure does. I think that you can write it long hand.

Dave: Man, long hands, I don't want to do that. I can't read it but I heard what you're saying.

John: Sorry, millennials.

Dave: Exactly. By the way, my kid's school requires that they learn how to write in long hands that they focus on it because of what it does to the cross patterning in the brain and all that. There's something you said for that too.

John: You know what it actually does? It forces you to repeat it. You're setting up a recursive repeater because you have [inaudible 01:17:00] find motor structure so that's why you learn it better. That's something you can empirically show. If you're typing, if you're tapping on something, you can't do that but if you have to do this micro limiter, you have to repeat it constantly. The repetition schedule is more robust in long form which is why it has to be a long hand.

Dave: That's what drives the learning and that actually makes a lot of sense.

John: Yeah.

Dave: People can find your work in the Brain Rules books. The most recent one though is Brain Rules for Aging Well. You've got couple other ones there. Just from hearing this interview, anyone who's thinking about like, "Is there something I could do better?" There probably is and you've been studying that stuff for a very long time with an animator's eye which is fascinating, awesome. Thank you for your time. Thank you for being on the show.

John: Dave, you were a delight to talk to and I thank you for your time.