The Latest on Stem Cell Therapies and Research  
(An Interview with Dr. Bryant Villeponteau)  

By: Dr. Joseph Mercola

DM: Dr. Joseph Mercola  
BV: Dr. Bryant Villeponteau

Introduction:

DM: Hi, welcome, everyone. This is Dr. Mercola, and today we are joined by Dr. Villeponteau, who is a leading researcher in novel anti-aging therapies, which include stem cell research among other things. He’s been a pioneer in this area and has been studying it for over three decades. We’re just really excited about learning what he has to share with us today, because I really believe that these are two novel technologies that could really have a dramatic influence on our ability to live long and replace some of our failing parts that’s sort of invariably a result of the aging process.

So, welcome and thank you for joining us today.

BV: Thank you, Dr. Mercola.

DM: I’m wondering if you could help us understand how you came to your current position and what motivated and catalyzed your interest in this area, and help us get a framework to understand what your current technology is all about.

BV: Sure, I’d be happy to do that. I started off going into science because I had an interest in aging and longevity. I sort of picked developmental biology. I thought that was the area I should go in. If we could understand development, we could understand aging. As I got more into that, I thought, well, it’s more gene regulation that was more important. I got into more of the gene regulation aspects.

I took a position as a professor at the University of Michigan at the Institute of Gerontology, by the way, which was studying aging. I thought that there I could really start to pull it all together. Being a professor wasn’t all I thought it would be, you know. You had to write a lot of grants.

I had an offer from Geron Corporation, which was a Bay Area startup at the time in the early ‘90s. They claimed they were going to be the first company to be an anti-aging company. They were working on telomerase, which I was pretty excited about at the time. I went. I joined them when they first started. We had an all-out engagement there to clone telomerase – human telomerase. It had been cloned in other animals but not in humans or mammals at all.
DM: Perhaps for those who don’t know what telomerase is, maybe you can give a short or little description of what that is in order to make sense of this and all that.

BV: Sure. Telomerase is an enzyme that is involved in repairing the ends of the chromosomes. Every time your cells divide, your chromosomes on the ends get a little bit shorter because there’s an end replication problem. You can’t quite replicate the very ends of the chromosomes. Telomerase is a particular enzyme that can add on and keep those telomeres, those ends of the chromosomes, from shortening. The telomeres themselves are repeated sequences of eight base pairs. That repeat has to be laid down by this enzyme, telomerase. That’s what telomerase does.

What you have to know about telomerase is that it’s only on in embryonic cells. In adult cells, it’s totally, for the most part, turned off, with the exception of adult stem cells. Adult stem cells have some telomerase – not full and not like the embryonic stem cells, but they do have some telomerase activity.

DM: What about reproductive cells like the sperm?

BV: Well, reproductive cells, of course, those are [embryonic-like 04:06]. Those give rise to the babies. Those do have high levels of telomerase. That’s the one tissue, one stem cell-like tissue, that has full telomerase activity. But every other adult stem cell is usually less than that in activity.

And then the other, of course, cells in the body that can have telomerase activity is cancer cells. It’s thought to be the immortalization principle. In fact, we showed this at Geron, when I was there, that if you put this back in, if you put telomerase back into the cells, they stop aging and senescing. You can actually keep them immortal.

Anyway, back to the thing. I came to Geron, and we actually had this crash program to isolate human telomerase. There was competition from academic labs, of course, but we were the first industrial lab to take this on. I led the effort, and happy to say, we were very successful. We pulled this out very rapidly. At that point, I became the champion of (what they call) telomerase therapy.

The founder of Geron was Michael West, who many of you may have heard of. He’s a pioneer in stem cells. Back in ‘94 or ‘95, he was looking for something else to bring to the company besides the telomerase and telomeres. He brought in the stem cells. What he did was he recognized that this was going to be the big new thing and that stem cells are where we could make regeneration of body tissues really practical.

What happened was that he went out. At that time, people had isolated the embryonic stem cells in mouse and in some other animals, but they had never done it in humans. He went and identified several groups that were working on the isolation of human stem cells. He got together a collaborative agreement with these people and part-funding from Geron. That bore fruit later in the ‘90s. That’s how Geron became both the telomerase and the stem cell king – it was because of that early support of the stem cell research. They had lines of stem cell, embryonic stem cells, before anybody else did.

DM: And you were involved in some of that initial research?
BV: Yeah. I was involved in a lot of that initial research. But what I came away with was that these embryonic stem cells, as good as they were, had problems, too. Because you had to isolate them, you had to grow them, and then you had to put them into a foreign body, if they were going to be useful. That means you have to worry about immunity, because it’s a different type of somebody else’s cells, right? That was a problem.

And then the other problem was that it was not that easy and straightforward to differentiate these embryonic stem cells the way you want them. Say, you want heart cells, you want muscle, or you want liver, it wasn’t that straightforward. I realized it was going to be more than a 10-year research project to do this. I started to be more interested at that point in adult stem cells. We’ll go in a little bit later with the differences among adult stem cells, embryonic stem cells, and this new thing (what we call) induced pluripotent stem cells. At any rate, suffice it to say, for now that became sort of an interest of mine.

I didn’t really take it up until recently. I mean, I didn’t really start working on it until in the last year, because I didn’t see the field moving fast enough the way I thought it should. Most researchers out there in both academia and industrial labs are working on induced pluripotent stem cells (iPS), which I’ll describe in a little bit, or they’re working on embryonics still. They’re not working on what I consider the easiest and most efficient way to go, which are adult stem cells.

But just to let you know, the adult stem cells have always had a problem. The problem is, yes, they’re your cells. You don’t have to worry about immunity. The problem is if you take them out of the body, there are not enough of them. Especially as you get older, there’s fewer and fewer and they tend to become more dysfunctional. They don’t form the tissues that they need to form. That’s another problem.

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What I have set up a company to do, which I have, I think, the technology and the expertise to do, is to amplify your adult stem cells a million-fold or more without them senescing (i.e. getting old) and maintaining their ability to differentiate all the different cell types, because that’s important, too. I mean, that will help you grow up these cells. I think that would be a game changer if you could do that.

Because what is hindering the use of adult stem cells right now… They are being used, and I’ll talk about that later. But they are being used quite a bit. That’s basically all that’s being used because they’re the only thing that is available now. But there’s too few of them, so the results are spotty. But there are results. There are some good results and successes there.

DM: But let’s get a framework, so that the average person would understand why they should be interested in adult stem cells. From my perspective, it would seem that they’re useful for regenerating organs in conjunction with something like 3D printing and some of the research I’m sure you’re familiar with that’s going on. That’s one application, but I’m sure there are many others. So, why should the average listener be interested in adult stem cells?
BV: Well, they should be interested in it because adult stem cells have the potential to really pretty much cure or at least ameliorate a lot of age-related diseases, because they can regenerate tissue. What happens with aging is (I've mentioned this before) that there's a decline of about half in the number of stem cells that you have. Also, what happens is the functional ability of these stem cells that do remain as you get older goes down. They can't form the proper tissues; they just sit there. This is a real problem. The turnover of cells becomes slower and slower.

You can see this the most in – this isn't the most important tissue, but in many people, they think it is – skin. Let's take skin as an example. It's sort of how we judge how old somebody is, right?

DM: It's an important cosmetic one for sure.

BV: That's right. It just exemplifies exactly what I want to say here. Okay, as you get older, everybody knows that your skin starts to get thinner. It is less elastic, so you have wrinkles. It becomes less tight. See, your skin is always wearing off. I mean, our surface is dead, dying, and flaking off. You have to have new cells being born all the time. Those are adult stem cells that are producing that new skin. As those become fewer or become non-functional, the turnover in the skin slows down by something like half.

Because the turnover is slower, that means that the average age of the cells gets older. Those cells get bigger. They get less functional. That's why the skin gets thinner. There's more buildup of extracellular fat cells there. There's more buildup of all kinds of other things – crosslinking of the protein and all of that – just because you're not turning over, you're not replacing, and you're not keeping up with the maintenance that is needed like what a young baby would have or even somebody in their 20s.

DM: Would your process then selectively identify these adult stem cells, put them into a process where they amplify them a million-fold perhaps, and then put them back in the body to regenerate or repair the normal aging process?

BV: Right. That's the general idea. The excitement here is that basically it's sort of, you know... You think about these old planes that are flying. They can fly. Some of these planes are 30 years old or 35 years old, and they keep flying. There's no problem, because they keep repairing the parts.

DM: Cars that are over a hundred years old.

BV: Yeah, you can repair the parts. You can do it. Of course, it's not a complete analogy because humans and all animals can repair to a large degree, but they repair by regenerating tissue, which is a stem cell function. If you can regenerate tissue, that's the key to keeping young. It really is the key.

DM: Is there any evidence to suggest that this is a theory? Or are there practical animal studies or human studies that show that this is beneficial?

BV: Okay, well, certainly we know that there's a lot experimental evidence and actually practical things where they've shown that particular organs can be repaired using this
technology. Now, the question you just asked is, for general aging, are we going to be able to replace your stem cells by, let’s say, IV putting stem cells in? We don’t know how much good we can do.

But there has been one rat experiment that’s been done. They were able to extend the lifespan by adding IV stem cell population – taking it out and putting it in there. They were able to do that. Now, the way they did it in this case, though, was they took young stem cells from young rats and put it into old rats. But, you know, if you could rejuvenate, which is what we’re trying to do, and amplify these things up. The problem, as I’ve said, with the older animals and humans is that they can’t. They don’t have enough stem cells and the stem cells they have are not of the right quality.

There actually is another aspect of this, too, though. In science, most things are a little complicated. As we get older, as we all know, there’s inflammation building up. That inflammation and general toxicity in the body that increases, that also limits the ability of this even if you had young stem cells or had fully functional stem cells to work their magic because that hinders the whole process.

You do have that aspect, too. I think you have to treat both aspects... That’s what we call the niche, the body niche, or the body environment, microenvironment. You have to lower the general inflammation there. And inflammation, as you probably well know, has been thought to be a cofactor in many diseases.

DM: I’m sure many have heard or know personally people who have gone to Europe or overseas to receive typically intravenously or intramuscular injections of embryonic animal stem cells – from lambs or... I think typically lambs, but there may be other animals that are used. Is this similar to what you’re proposing? Are you aware of any benefits from this type of process?

BV: When you’re talking about these foreign clinics, you’re talking about very different, you know. I mean, it depends on the clinic. There are shysters out there, there are scams, and there are people who really haven’t applied the scientific way of doing this. They’re trying to make money. You have to be very selective there.

Unfortunately, the way it’s set up in the United States, it’s illegal to amplify any cell and then put them back in. The FDA considers that a drug. That’s why people would have to go abroad if they’re going to put... Especially if they’re putting animal tissues in you. I wouldn’t recommend the animal tissues.

Now, there are a lot of foreign research centers or hospitals that are using legitimate stem cell therapy. If you want, I can go into that now. There are a lot of successes there.

Even in the United States, it’s legal to take, let’s say, bone marrow stem cells or to take a fat tissue and isolate the adipose stem cells. You can do that legally now in the United States. You can isolate them as long as you don’t treat them with any drug or try to grow them. You put them right back into the body after you’ve isolated, purified, and concentrated them. You can put them right back in to various places. That’s legal. There are doctors in the U.S. as well as abroad who have used these treatments.
The most common thing right now is for things like knee injury. I was talking to somebody who does this work, and he said that they are getting very successful results with people who would otherwise need all kinds of normal knee surgery, where they get very invasive stuff. They’re getting very successful results. But it’s like one percent. Right now they’re saying that while it’s only one percent of the total number of people who typically get some kind of knee work done using stem cells, they’re actually getting cured doing that. They’re getting very good results with this kind of thing.

Of course, it’s usually hip therapy as well as if you’ve got a hip operation. It’s really good for bone growth, joint problems, and that kind of thing. People are using it in the back as well, you know, for back problems. For that kind of thing, it’s been very useful. Anecdotally, by the way, I even had some work with my front [tooth]. I had some front tooth. I had some bone loss there. I had some stem cell therapy in it. It actually very much helped in that case as well. It’s being used for that kind of thing right now.

By the way, one of the oldest uses for stem cell has been around for 20 years. You’ve probably even heard of it. Cancer patients, if they get high levels of radiation to try to kill off the cancer, it kills off your stem cells, your blood-forming stem cells. What they’ve been doing in some places for 20 years now is to take a sample of your bone marrow and then replace it after the chemotherapy or the radiation therapy to regrow your immune system quickly. They can do that several times. That allows you to go to much higher dosage of radiation that you would otherwise have and [not] be able to survive. That’s another area that’s still on going.

Heart tissue regeneration is something that has been seen. It’s spotty. But people have seen that in some clinical trials here and in some of these clinics abroad. But it’s spotty because you realize that the quality and the numbers of stem cells you can get out of an adult, it varies quite a bit. You expect it to not work that well.

DM: Are both of these treatments being done without the amplification process that you pioneered?

BV: Right. Currently, the amplification process to the degree that’s done at all even abroad, the problem with it is they divide the cells. You can only amplify them about a hundred times, and then you start to lose function because they start senescing like [inaudible 23:45]. That’s what we want to try to avoid. That’s what we’re trying to develop, where you don’t have that problem. But that’s the problem right now even if you could do it in the United States legally. It could be done abroad, but it’s been only marginally better because of this senescence problem, the cellular senescence problem.

DM: With the applications you mentioned, they seem to be related more to non-specific administration of the stem cells.

BV: This is IV, right.
DM: And then maybe you can comment on the difference of that versus using a 3D-printing architecture, where you have targeted stem cells and you actually recreate the organ – that’s legal – and then implant it. I think there’s some research. They’ve done it successfully. I mean, I know they’ve done esophagus. I think they’ve done ears. But you know, the larger functional organs like the kidney, pancreas, or liver have yet to be done successfully as far as I know, certainly in humans, possibly in animals.

BV: Well, that’s right. Right now most of that work is being done with iPS cells or embryonic stem cells, not with adult stem cells. They’re using whatever tissues are available right now. There’s a lot. This is just in its infancy really. The research has just started not that long ago. There’s a lot to be learned. But yeah, this has tremendous potential. Again, that’s why the technology [inaudible 25:25]. But to amplify these cells without aging them is so important.

The reason that embryonic stem cells can be amplified much better is they have such long telomeres. They’re starting out much younger. Obviously, they haven’t been through all the development.

If you think of the telomeres, let’s say, they start off at like 15 kilobases, 15,000 long of these repeats. By the time you go through development, you’ve already lost about 5,000. A young adult has 10,000, let’s say, in their 20s. It usually is reduced. If you get to 5,000, you’re probably dead. I mean, that’s how, you know. They have to have a certain minimum to survive, for the cells to survive.

At any rate, that’s the reason that people are trying to use these younger cells. Most of this work is done that way now. They’re not done with adult stem cells. But most of the clinical work is done with stem cells – I mean with adult stem cells – because they’re easier to get and they’re safe. I haven’t gone into the… I want to do that before we stop. I want to go into the different types and what are the advantages and disadvantages of them at some point.

DM: Why don’t you do that now? I have a few other questions. But let’s do that now.

BV: Okay. There are three major types of stem cell populations or areas: one is the embryonic that I just mentioned. Now, the (1) embryonic stem cells come from embryos, as you might expect. There are ethical problems that have been raised. That’s where all President Bush’s proclamation that we’re not going to use these stem cell lines [came from]. That’s because they had to destroy the embryo in order to get those embryonic stem cells out. Those are called embryonic stem cells.

They have another problem. That is it’s more difficult for them to form or to find a way for them to form the individual tissue types that you want, because they’re kind of far removed from those individual tissue – say, liver tissue, brain tissue, or muscle tissue. Because they’re so young and immature, it’s not easy to program them to those later stages of tissue. That’s another problem.

They have a problem of cancer potential because they form keratomas, although that’s rare. And of course, because you’re getting them from an embryo, you’re going to be growing them up and then putting them in different people, you’ve got a potential of
immune problem because your own immune system is going to say this is foreign tissue, although stem cells have a natural way of not listening to immune response in many cases. But we don’t know what will happen long-term.

At any rate, that’s the one type. That’s the initial type. That’s what Geron started with. They were the first to have this. That’s why the presidential line… I think most of the presidential lines that they allowed were embryonic stem cell lines. There were 16 of them or something. I think 10 of them were from Geron. There were some from Europe and things like that. Okay, that’s the type.

What’s gotten academic researchers and many others very excited most recently – it was about 2008 when this happened – was what they call (2) iPS, which is induced pluripotent stem cells. These cells, they can take a fibroblast – let’s say, a skin fibroblast, for example – even from the lobe of your ear or from your arm, and transfect it with or put in four different genes that are known to be important for stem cell function and convert that cell of yours, that end cell, a different shade of cell, into an embryonic stem cell, your embryonic stem cell.

That’s been a very exciting development. People were doing a lot of work with that. It has its own problems. Of course, it doesn’t have the immunity problem because it’s your own cells, right? It’s your own tissue. That is not a problem. It still has a cancer problem because you’re forming this thing. It has a cancer problem. Whenever you put genes into a genome, you have a potential of putting it near a cancer gene and generating cancer that way. There’s that safety issue.

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They also have some issues with how you differentiate them into the liver, brain, and muscle tissue that you need. There are various issues there. But it does solve some of the problems. That’s been a very exciting area.

Most recently, they’re trying to do this conversion without putting the genes in at all, but by using chemical drugs to activate those or to sort of put those genes, those stem cell genes, that are kind of asleep, wake them up and convert it that way. Very recently, within the last couple of weeks actually, there was one group that was able to take, I think, seven chemical drugs and convert a small proportion of the fibroblast into these iPS cells, doing it just chemically and not using any genes.

Of course, that’s much safer. But we don’t know the full impact of what that’s going to mean yet. But anyway, that’s the way they’re progressing, trying to get it to be safer. But I would say that using that in a clinic would probably be five to 10 years off. Still, a lot of work has to be done.

The last category we’re talking about are the (3) adult stem cells. They don’t have the immunity problem because it’s your own cells. They don’t have the ethical problem; it’s your own cells. I don’t think there’s ever been a case demonstrating where they can cause cancer. That’s another big advantage.
The disadvantage has always been they’re difficult to grow and that there aren’t enough of them to have a really big effectiveness. It would be a real game changer if you could amplify this up. Take the few viable stem cells or adult stem cells that are there, amplify them up, and be able to put back a lot of new vigorous cells in the body.

**DM:** It sounds like that is the key, this amplification process that you’re working on.

**BV:** Yeah, at least for adult stem cells. But for the iPS and for the embryonic stem cells, they’re so young to begin with. They do pretty well.

**DM:** They have their own problems, which you just reviewed.

**BV:** Right.

**DM:** The most practical implementation and the least offensive one from a number of parameters would be the adult stem cells.

**BV:** Right.

**DM:** But you are able to circumvent the challenges with those, which is a number of them. So, how far along are you with this amplification research? Are the others doing it? Do you have any projections as to when that might be available if you might succeed in solving that challenge?

**BV:** Well, we’re just starting. I mean, we have developed the media. We think we have a procedure that will work. To do this properly, we’ll take at least a year. One to two years is what we’re thinking to prove our principle, where we can show that what we have done succeeded.

It’s not just a matter of will they grow, because what happens with it normally is they stop growing after a while. Okay, you get them to keep growing. You also have to show that they’ve maintained their stem cell-like function. They’ll still be able to form all the different tissue types, because that’s their function. You have to show all of that. That’s a lot. I think it’s probably a one-and-a-half to two-year project.

**DM:** Okay. Well, that’s not that long actually. But I’m wondering if you could comment on the similarities between another process called polymerase chain reaction (PCR), which is a process that was really exciting when AIDS research in the late ‘80s allowed us to identify it and diagnose it. It’s a similar technology, where you’re amplifying to very large levels. But my guess is that you’re not amplifying the whole cell; you’re just amplifying segments of the cells.

**BV:** Yeah. The PCR was revolutionary obviously. What you do there is you take a segment of DNA. Because DNA is double-stranded, as we all know, you put a single strand of piece of DNA that hybridizes to one chain on one end and another one on the other end, and then you keep it amplified in both directions. You amplify a little section of it. That’s right. You can amplify it multiple millions of times, although you start getting noise the higher you go. Normally, the noise level gets really too high after you’ve done
35 or 36 doublings or amplifications, where you double. Every time you do it once, that
doubles. It goes 2, 4, 8, you know.

**DM:** It gets pretty high after the 25\textsuperscript{th}.

**BV:** Yeah, it does. It’s 2 to 25, right?

**DM:** Yeah.

**BV:** That’s right. Anyway, you can see most genes, even low-frequency… Well, it
depends on what you’re talking about. But if you’re looking at messenger RNA, for
instance, or expression, you can see below 20 doublings. If you’re talking about rare
genes, you have to go… Telomerase, for instance, is a very rarely expressed gene. You
have to go above 30 for that.

**DM:** It’s really pretty much an entirely different technology that you’re using to amplify
this.

**BV:** Oh, fairly.

**DM:** Not even close.

**BV:** Not even close.

**DM:** All right. The two-year projection you gave us is actually quite encouraging. When
do you think it’ll be practical and widely used, so that we can start doing more
experiments to improve the use of human stem cells and hopefully integrate them into
this 3D printing technology?

**BV:** Well, if what we’re trying to develop works, as I said, it will be a game changer.
Because the safety is already kind of taken for granted right there, you’d have to prove
some safety aspects of it. But it could go pretty quickly into the clinic, at least as a
clinical trial. I mean, you wouldn't want to just do it. Here in the United States, you’d
have to do a clinical trial anyway. That’s how you would do it to have to get it approved
by the FDA.

Abroad, you could actually… If you thought it was safe enough, you might be able to
start… People start using it abroad in some of these clinics, where they don’t have all
the regulations here. But I personally wouldn’t, you know. I’d be very careful before I
would release it. But I think that inherently it’s much safer. We don’t know yet.

One of the things we’ve acquired is a collaboration with Sierra Sciences, if you’ve heard
of that company.

**DM:** Bill’s company, right?

**BV:** Bill Andrews, yeah, who’s a friend of mine. He’s going to provide us with his drugs
for telomerase stimulation. We don’t think we’re going to need them because we have
other things that we think already work well enough. But if we do, we will. We’re going to
be screening them if we need them. If we need them, and we find a certain drug and
maybe it has some side effects, we have to worry about that. Maybe then you have to do more testing before it’ll be ready – for safety reasons – to go into a clinic.

**DM:** Maybe you can comment on this, too. Because I was intrigued with the telomerase principles to potentially extend human lifespan. But after talking to a few other clinicians, they warned us. They had some serious concerns about it. But in this application, your amplification process of human adult stem cells, seems to make a lot more sense, if, in fact, you need it for your process, because it’s targeted on one cell type. When you start using a generic to include the whole body, you have no idea what type of mess you’re going into.

**BV:** Right, exactly. You’re very perceptive on that point, Dr. Mercola. Actually, here’s the issue, I think, with telomerase activation systemically, if you’re taking it systemically...

**DM:** Right.

**BV:** It probably doesn’t do much of any good, for most 99 percent of your cells are not going to be affected nor should they be. You don’t even want them to be, because there’s a natural... The somatic cells in the body, the cells that do all the work – muscle, nerves, and all of that – they have a natural lifespan.

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Maybe you can do certain things to extend it a little bit. But you’re going to do only a little on the margins. They’re going to be dying and they have to be regenerated. There has to be a regeneration process. They used to think that certain tissues like the brain and heart muscle didn’t have any stem cells, didn’t have any new growth. That’s not true. Now we found that they do have them. In the case of neuro, it is very important for memory that you have this capability. I think where the telomerase activation really helps, even taken systemically, is in the stem cell compartment because it would help with your own stem cells.

We have a product that we’ve been selling commercially, which is another aspect of things we were doing earlier, to stimulate stem cell growth and maintenance of the stem cells, and telomere function is part of it. We only think that’s part of it. With all of these things, aging itself and stem cells are multi-faceted and multi-pathway. You really have to attack it from different pathways. There’s no magic bullet in its treatment. You have to get in multiple ways, because aging is a process that is multiple pathway. I can go into that more.

**DM:** I couldn’t agree more. I’m really excited about the work that you’re doing because I do really think that it has tremendous potential to make a significant dent, as it provides us with a phenomenal resource and tool in the future to take care of some of these problems. I’m wondering if you could maybe list the top three, four, or five indications once you are successful, have this, and it has gone to the approval and regulatory processes in its use and that research. What do you think are the top five indications? And then secondarily, what is your projection as to when we might be able to access that technology?
BV: Well, right now, as I said, the top one would still be joint. But you’d be able to do even more effectively. Any bone growth and any bone loss would be able to be repaired. Diseases, certainly diabetes. You should be able to recreate the pancreas. Those kinds of things should be doable.

Heart regeneration, there are two things there: one is the heart muscle itself. As you know, certain type of heart damage is, you know. That’s why people try to get a heart transplant, because it’s so damaged. You could regenerate the tissue in place if you had the right stem cells there, you know, injected into the right place. That’s a big area that I think will be…

DM: For the application you just mentioned, that really would just repair the existing heart. It wouldn’t necessarily be putting in a newly created heart from adult stem cells.

BV: Yeah, those are two different things. Ideally, you could just repair the initial heart. But if you can’t do that… If it’s so damaged, you can’t do that. I’m sure there’ll be cases where that is true. Making new hearts, yes, you know, doing 3D printing and organ generation, is going to be a big business. But that’s more long-term. Although as you say, I mean, I think you mentioned the windpipe of someone.

DM: [inaudible 1:03:54]

BV: Right. Yeah, they’ve already done that kind of thing. I think you’ll have more and more. The simple organs will be done quickly in the next few years. But if you’re talking about heart, kidney, liver, pancreas, or you’re talking about more complicated organs, those will take more than a five- to 10-year realm. But they’re going to be done.

One of the problems is getting a good source of stem cells. If it’s possible, if we succeed, or if it works out with the iPS cells, I think you’re going to see a lot. That field is going to be accelerating greatly, and you’ll see these things coming on board very quickly.

DM: Interesting.

BV: Another area that I think is going to be very big is the general reconditioning of your capillary and your whole cardiovascular piping, so to speak – the artery, veins, and capillary. I don’t know to what degree the people who see this would know this, but with age, the capillary bed thins out quite a bit to the point where it may be 50 percent of what it should be or what it is when you’re young.

What that does is you start starving the organ for food, toxic waste removal, and oxygen that it needs. And of course, in that microenvironment of not enough vasculature in there, what you get is an outgrowth of more fat tissues, which tend to be better able to withstand those kinds of environments. Also, it promotes cancer because of cancer cells obviously, and then fibrosis. You get the extracellular matrix being thrown out.

If you could regenerate a young vasculature system, which is, of course, by putting in stem cells that build that back up, that’s really big. There have been quotes that you’re as old your arteries. You’ve probably heard something like that, and it’s very true.
Because obviously, if your organs aren’t fully functional because they’re not getting the food and oxygen they need, that’s really not going to work very well. Anyway, that’s another area.

The other thing would be autoimmunity. There are a lot of autoimmune diseases that apparently can work very well with this, because your immune system is another thing that gets old. As it gets old, it starts making errors. That’s something you can rejuvenate pretty readily. Multiple sclerosis (MS) disease is another one.

Stroke. There is a doctor in Utah right now who claims to have a positive effect on many patients, stroke patients, regenerating brain function. What he does is kind of novel because he’s using… At the upper end of the nostrils, there’s a tissue or membrane in there that actually has access. You can actually go into the brain. As you know, the blood-brain barrier prevents most cells or anything from getting into the brain unless it goes past that blood-brain barrier. But there are tissues in there that allows the cells to get in. He’s using that effectively and has had some success with that treatment.

Well, we just talked about organ replacement. That can be huge. But then the most exciting one, I think, is… We don’t know the full import of it yet as to what degree you can rejuvenate. Take somebody who doesn’t have a disease but they’re 60, 70, or 80 and getting pretty old. They’re fragile. They need general rejuvenation. To what degree would putting in various big doses of your stem cells that have been rejuvenated and young will rejuvenate your whole body?

Now, the only experimental evidence we have for this right now is the rat experiment I told you about, where they put it from young rats to old rats, and there was an extension of lifespan. But what we know is the old rats have inflammation. They didn’t optimize this. The extension was about 15 or 20 percent. It wasn’t great. But I think you can really increase or bump that up quite a bit. We don’t know what the real limits are for that.

And then of course, we don’t know whether that would be injecting IV, which is what they did and which is simple. But how about the brain? How are you going to get it in there? There are questions about that, too, that we’ll have to address. I mean, there are certainly ways you could maybe inject it into the spinal fluid or something like that. But that gets more problematic because there can be infections and stuff like that. That will have to be worked out.

First thing, there are already people now who are taking stem cell therapy who are healthy, are claiming some kind of rejuvenation effect using fat adipose tissue, bone marrow, or a mixture of the two, and taking them regularly every three to six months.

**DM:** This is a…

**BV:** In foreign clinics.

[----- 50:00 -----]

**DM:** What is your best guess as to if that’s real or just a placebo effect?
BV: It's hard to say. It really is. I know that some of these people have… One of the colleagues who I worked with was collaborative in setting up one of these foreign things at Guatemala. Actually, they moved from Guatemala to Panama Zone just recently. He has seen the statistics that they have. Most people aren’t helped, but there are a few who seem to have dramatic effects. It’s hard. It’s really a case by case basis. I would think that right now with the technology being the way it is, it’s not going to be very effective and probably not worth the cost or the effort. But it’s probably safe.

DM: That’s really encouraging. When I think about aggressive future efforts to reverse the aging process, nanotech comes to mind. In our discussion, it has become somewhat clear to me that the technology you’re working on is really creating a biological nanotech. I’m glad…

BV: Right.

DM: Rather than using atomically precise printing to create little nanobots to go around doing this repair, it would seem far wiser to focus on the already intrinsic intelligence, where the body has to do this repair selectively and wisely, and to leverage that first before you start going into more of these exotic ones, which I’m not sure we’ll ever see in our lifetime. It’s possible. I mean, that’s one of the things. It’s the exponential growth of technology. Once you get to that 25\textsuperscript{th}, 30\textsuperscript{th}, 35\textsuperscript{th} doubling, it’s just shocking what gets produced. It’s still…

BV: Well, that’s Kurzweil’s ideas about this, right. Yeah, I agree with you. I think that it is a race between the biological and the kind of synthetic, if you will, for the nanobot type of thing. Certainly, the stem cell revolution is going to be a lot quicker than the nanobot thing. With the nanobot, I worry about how do you get rid of those things after you put them in? I mean, stem cells all die off. Cells die off in your body all the time. They’re torn down. The body has a way of getting rid of them. It knows exactly what to do. It has all the enzymatic means of doing it.

But these synthetic things, it would be like having plastic in your veins. I’m not sure how that would work. Maybe there’s a way you can put them in and take them out. They’re going to have to think about how to get them out afterwards.

DM: Yeah.

BV: Or they’re biodegradable. They’ll maybe make some kind of biodegradable, some kind of artificial cell, which there are. As you know, they’re already working on synthetic bacteria. Maybe they’ll do something like that. That would be the nanobot that I would see. But there’s going to be a race between these two things. I don’t know which is going to [succeed] in the end. Long-term, it may be the nanobots that will win the day. But in the near term, I think it’s going to be biological processes.

By the way, just let me say one other thing. I have a book, which I’ve just spent years writing. Finally, it’s going to be published early next month after Labor Day. It’s called *Decoding Longevity*. That’s the name of the book. I looked into what you can do today in your life, mainly diet, exercise, supplements, and some drugs. And then what would happen in the future. Well, what we know already and what we can do in the future.
The last chapter, I actually go into... I have a chart that talks about the different – nanobots being one of them – technologies where eventually I think by mid-century we may certainly have solved the aging process with.

**DM:** That’s encouraging. I really want to keep current with your products and the research that you’re doing now, because to me, from my perception, it seems to be one of the best hopes we have for a more immediate success. As you achieve your results, we’d certainly like to keep updated. Aside from purchasing your book, which you just mentioned, is there any other way to keep current on what the status of your research is?

**BV:** Well, the company is called Centagen.com. You can go in there now. It’s not been updated recently. But if anything big happens, we’ll be notifying people through there. And of course, you know Dave Kekich. He’s part of it, too. Of course, he’s been trying to put a fund together to fund all these technologies for longevity, as you well know. He thinks that what we’re trying to do and what I’m trying to do is top priority right now. He’s certainly in on it. He’s pushing it as hard as he can. If you talk to him, you can keep abreast of it, too.

But it’s Centagen.com. You’ve got my email whatever. I will be putting up press releases. If we succeed in this, it’ll be big news. You won’t miss it. That’s for sure.

**DM:** Well at least we’re sensitized to it. Without this grounding or framework to understand what the whole perspective is, it’s difficult to appreciate when you see or read a press release.

**BV:** Right. There are so many of them. There’s just so many of them. There are so many technologies. So many of these things are dead ends. I can get excited. I was excited at Geron by what they were doing in the stem cell field. But I realized that, as exciting as this was, it is going to be a long-term process to do this. Geron after, I think it was 11 or 12 years... Anyway, last year or more than a year ago, they gave up the stem cell work. They gave it up. They had been doing clinical trials. They gave up on it. They say to focus on the cancer aspect, which was always big and their thing. But it was just too long-term what they were trying to do.

That’s one of the reasons I’m getting back into this area. I see this as the only way progress will go forward. I’m getting older. My family's getting older. I mean, I want to see it. I know a lot of people who are dying already. The Baby Boomers are dying off. It started. You really got to make progress quickly. I think stem cells are the fastest way. I think you can add 20 years to your life now if you eat right, take the right supplements, and exercise. You’d delay diseases all and that, but that’s all you’re going to get.

**DM:** Right.

**BV:** You’re not going to get extreme changes. To do that, you need real science.

**DM:** I couldn’t agree more. Well, I thank you for the time, for all the research, efforts, dedication, and for helping advance the science to help create tools that all of us will benefit from in the future.
BV: Thank you for giving me the chance to talk about it.

DM: All right. It’s exciting. I really appreciate the opportunity to connect with great guys like yourself who are making a difference.

BV: Okay, thank you. Talk to you later.

DM: All right.

BV: Talk to you later. Bye.

[END]