Im a Mortal Episode 3: Aubrey de Grey – The End of Aging

Speakers: Aubrey de Grey (Guest), Sufal Deb (Host), Marvin Yan (Host)

[MUSIC - Im a Mortal Theme]

Aubrey de Grey 0:27

Hey everybody, I am Aubrey de Grey. I am the Chief Science Officer of SENS [Strategies for Engineered Negligible Senescence] Research Foundation, which is a biomedical research charity based in Silicon Valley. Our work is focused on bringing aging under control. Specifically, we want to extend perhaps indefinitely, the time that people can stay youthful, rather than going downhill at a particular age as they tend to do these days. The way that we are going about it is by developing a variety of technologies that are focused on damage repair in the body. The body ages very much like a car ages. It does itself damage as a consequence of its normal operation. This damage is initially harmless because the body like a car is set up to tolerate a certain amount of it but eventually when there's too much damage, we start to exhibit decline in function. Our goal is to do preventative maintenance on the body in a wide variety of different ways, addressing each different type of damage. That sounds like a big deal and it is otherwise we wouldn't need to exist. We believe that we're getting close to being able to achieve it. That's what we do.

Sufal Deb 1:40

Great. Our podcast is called I'm a Mortal so of course, we have to ask you— I know you've mentioned before that your work is more for “immorbidity” rather than immortality. Regardless, what does the word immortal or immortality mean to you?

Aubrey de Grey 1:54

You're absolutely right of course. The word immortality is extremely loaded. I have distanced myself very aggressively from that word since the beginning of my time in the public eye because ultimately, it has legitimate connotations of religion. It's taken. Its meaning is established. Everybody knows that true immortality is technologically impossible, that there will always be a nonzero risk of death in the coming year or whatever. Doesn't matter. Even if we got uploaded, the computer could be fried by a supernova, things like that.

The fact is, I really need to avoid that word and I need to do it quite aggressively because people use it as a kind of trick, as a kind of crutch with which to maintain a kind of emotional distance from the whole question of bringing aging under medical control, which is of course, itself a perfectly realistic scenario. They kind of use it to help themselves keep pretending that what we're talking about here is really just science fiction and therefore only entertainment, and we don't really need to care about it very much. If you ask, why would they want to do that? Of course, that's also an easy question to answer. The answer is because they're terrified of getting their hopes up and being emotionally invested in the prospect of actually benefiting personally from the advances that haven't happened yet. They know they can't do that because they don't know how soon the advances are going to happen. I don't know how soon they're going to happen. It's all psychologically perfectly easy to explain but still, where it leaves me is that I have to really distance myself from the word immortality.

Now before I let you go on, I want to say one word about the word longevity which is a very different situation. Here, we have really made an enormous amount of progress over just the past few years I would say. You will find all over the internet, all over the public conversation, the use of the word longevity to describe what we do, to actually— that we will extend longevity. Now 10 years ago, certainly 20 years ago, that was 180 degrees different. Everyone who was trying to be influential in this field, was kind of apologizing for longevity. They were saying, okay, what we want is health, we want healthy longevity for as long as possible. They all accepted implicitly that longevity is a side effect of health, though, in fact, I think I was the first person to come along really aggressively say, listen, this is the word we should be using, side effect. The point is there was this implicit acquiescence in the idea that it was a drawback, it was a bad side effect. Now we've got to the point where people aren't doing that anymore. They're recognizing and celebrating the fact that it's actually a good side effect.

Marvin Yan 4:51

Okay, wow. Thank you for answering— actually, we had some other questions, but jumping back because 20 years ago, we didn't exist. We're actually 20 ourselves. Nowadays, I believe it's only really you who's come out and sort of really pushed the damage repair aspect of aging and none of your colleagues ever really— at least in the same field, have spoken out about it. So going back 20 years, how did you generate the momentum to really start all of this off?

Aubrey de Grey 5:20

You are right and wrong there. Yes, I was certainly the first person to come along and promote the idea of damage repair within the field as being a way to go. There were a number of reasons why my presentation of this took a long time to gain traction. One way was that, I just wasn't very good at that— it's very difficult to get a very new idea across within a scientific field. I wish I could have done it better from out of the gate but it's the way things are. Second reason, however, was a bit more profound, namely that it just sounded implausible that damage repair, reversal of aging, would be actually easier than slowing aging down by making the body if you like, run more cleanly and generate damage more slowly in the first place. That was a very counter intuitive abstract concept that I had to work very hard to justify. Of course, there was also the political side that by virtue of the fact that the rejuvenation paradigm leads very quickly to the concept of longevity escape velocity, I was making very politically incendiary predictions about how long people who are already allowed today would actually live. That didn't go down at all well, either. You can say that there was there was a lot that I had to kind of push back on and educate my colleagues on in relation to getting this going.

However, where you're wrong is with regard to how things are today. It took a lot of work and for a couple of years— back 15 years or so ago, it was quite acrimonious, actually. By the late 2000s, really, this was over. People pretty much knew that I wasn't talking gibberish at all, that actually, I was making a lot of sense. There was still a case of a bit of dust having to settle because of the acrimony that had preceded that period. The real end of this whole episode happened in 2013, when the publication happened of a paper in *Cell*, a very prominent biological journal, of course, called *The Hallmarks of Aging*. Now, that paper is absolutely a root and branch restatement of what

I had said more than a decade earlier. Its time was right, it was out of my time, everyone's got to be, right? Everyone's got to make a difference ahead of their time but the field was ready.

This paper was embraced with almost indecent fervor and has become really literally, tantamount to Holy Scripture in the field. It is by far the most highly cited paper in the whole of the biology of aging in the past decade and so I never need to justify the damage repair paradigm to my colleagues anymore. I should actually—before I finish, I should emphasize one other aspect of why it was difficult, why there was resistance in the field. That was because of a poor level of consensus on the definition of aging.

Gerontologists tend to view aging as the thing that matters, of course, it is what they work on, right? Then they what they do is they view the health problems of late life as kind of consequences of aging. I think that's an oversimplification too far. I think that it's important to view aging as being the combination of the two processes, the lifelong process of accumulating damage, and the late life process of pathology. The reason that's important is because it helps us to distinguish between, on the one hand the damage repair approach that I've been promoting, and on the other hand, what I often call the geriatrics approach, which is essentially addressing the individual health problems of life individually, just like individual diseases.

The reason that was so important within the field of gerontology when I was presenting this idea for the first time, is because the whole field of gerontology more than a century ago, essentially emerged because of a rejection of the geriatrics paradigm and understanding that, one disease at a time is just never going to work. It's a whack a mole thing, right? At first people couldn't see the difference. People thought, well, antibiotic's proposing a divide and conquer approach as well, right? They couldn't see the difference. That took a lot of explaining.

Sufal Deb 9:36
Okay, wow. Yeah, that was a great explanation on that.

Marvin Yan 9:38
Oh, I have a question because it relates to this, which is because you worked in this field longer than we've been alive as I said before— I believe you said you were interested in AI and work and now you spent the last over two decades working in this field now. How has your idea of life and death in general changed since you first started?

Aubrey de Grey 9:56
Essentially, not at all. I always knew that aging was the number one most serious severe problem for humanity. The thing I didn't know until I hit about 30 in the early 1990s, was that biologists didn't think that way. I had always gone through life with this delusion that everyone in the world agreed because it was so bleeding obvious, that aging is the number one problem for humanity. I had discovered when I was 15, that I was a damn good programmer so I decided to work on another problem. I believe that it is definitely a very bad thing that most people have to spend most of their lives doing stuff that they wouldn't do unless they were being paid for it. Therefore, the more automation we have, the better. I thought, well, my talents lie in this area, that is where I shall focus

my talents and my effort. I never had any doubt that this problem pales into insignificance compared to the problem of aging. When I discovered, as a complete bombshell for me, that aging was actually being completely neglected by almost all biologists, then I thought, well, screw this, I've got to switch fields. I happened very fortunately to be in a position where I could switch fields. I engineered myself into a job that was very undermining and gave me a lot of spare time, which I had done in order to be able to self fund my AI with it. I just had to repurpose my spare time and that was a relatively straightforward thing to do.

Sufal Deb 11:28
We've talked about aging in the past, the aging field in general, and the past and the present. Where do you think all of this might go and say, two decades in the future? 20 years in the future?

Aubrey de Grey 11:37
Well, 20 years is a long time in the future.

Sufal Deb 11:40
Of course.

Aubrey de Grey 11:42
In general, I tend to be rather reluctant to make predictions even that far out. I mean, people, interviewers will quite often ask me to make predictions 100 years in the future, and then I'll just say piss off. The thing about even 20 years in the future is of course, we're talking about a timeframe where we may or may not have achieved longevity escape velocity. I currently put the 50/50 chance of having done so at 15 years from now.

Perhaps the more effective— essential variation on your question, is to talk about how life will be shortly after we have achieved longevity escape velocity, all right? Actually, I'm going to change that as well but only after I have kind of slightly answered it. The reason I'm only going to slightly answer that question is because it's actually not the most interesting question. By that time, yes, we will have therapies that are able to sufficiently comprehensively repair people so that we can stay one step ahead of the problem thereafter. It will be absolutely certain that there's no way we will ever slip back below longevity escape velocity by making inadequately rapid progress, because I'm sure as you all understand, the rate at which we need to make subsequent progress actually slows down.

All right, so that's all very well, but you have to think about what the difference is going to be in terms of the world. Now, of course, one thing that would not have changed at all at that point, or hardly at all, is the demography. We won't actually have chronologically old people over 200, because they'd have to be over 180 already, right? What we will have is a precipitously declining number of biologically old people. In fact, we might, if we got our sh*t together in the previous decade, be able to anticipate this advance sufficiently well in terms of front loading and investment that we could really launch this on the world fast. We could even in as little as five years following the treatment of longevity escape velocity, we could be there. We could have basically eliminated age-related health problems altogether.

The more interesting question is, what happens in the run up? I've already just alluded to it by talking about the decade and the run up. What will that decade consist of? What it's going to consist of is panic. Well, not exactly panic, but a great deal of chaos because people are going to have shifted to a position of expecting to be around long enough to benefit from these therapies, even though the therapies have not quite arrived yet. Right? That is a very interesting situation to be in, because it, first of all, obviously, it makes it electorally impossible to get elected unless you have a manifesto commitment to speed this up. Every day saves a 100,000 lives worldwide, right? Also, of course, the infrastructure, the front loading of investment, and trying to get medical personnel in and such like.

On top of all that, we have to think what people's initial spending decisions will be and I'm talking five years from now, not even 10. If you think about it, the things that are the biggest ticket items, except perhaps educating one's kids in people's lives are related to that. What kind of life insurance you want, what kind of health insurance, what kind of inheritance arrangements, that kind of stuff. The real kicker here is that the switch from today's mentality where people almost everywhere in the world thinks they're only going to live very slightly longer than their parents did into a mentality where people realize they're going to live more or less indefinitely, that is going to be incredibly sudden. It's going to be virtually overnight that that switch is going to happen. Worldwide.

Why? Because the world are fundamentally sheep. When Oprah Winfrey says something, everybody believes it. I mean, I'm talking only slightly elliptically, right? There are a small number of people who basically dominate opinions around the world. Now, how did Oprah Winfrey get where she is today? The answer is, by having her ear to the ground, by being very good at seeing when an expert opinion on a particular trend, on a particular topic, is changing, and getting ahead of it and saying the right things, and getting it right. Oprah Winfrey is listening to me but she's also listening to the other dozen thought leaders in the biology of aging. She is not interested in me. She is interested in the center of gravity of the public statements of that small coterie of experts.

Now, I've been out there saying the end of aging is foreseeable for the past 15, 17, 18 years, but nobody else has until now. We're just seeing the first shoots of changes in that. Some people have heard of David Sinclair, great friend of mine, professor at Harvard, excellent guy, done very important work in this space, isn't scared to go out on stage and on camera and say what he thinks up to a point. He wrote a book 18 months ago, whose subtitle was, *Why We Age and Why We Don't Have To*. That's pretty much equivalent to my book from 2007 that was called Ending Aging. You may ask, why didn't he write his book in 2007? He certainly could have but there's a very easy answer to that question.

He's a professor at Harvard which has plenty of advantages but it has the disadvantage, that if you do things like that, you're going to have a very uncomfortable conversation with your dean. You're very unlikely to get your next grant application funded, because the people who are making that evaluation will say, oh, dear, this person says irresponsible things to the media. So even David, who is very much not a coward, is has been absolutely is to some extent, in a position of having to be a little bit cautious, in fact very cautious about what he says. But the fact that he's now starting to come out and say slightly more aggressive things— he's not the only one, George Church is doing it, Nir Barzilai's doing it. We're on the cusp of the point where the center of gravity will move enough

for people like Oprah Winfrey to pay attention. You are about to see the biggest change in public opinion on the health and longevity that you could possibly imagine.

Sufal Deb 18:23
Okay. Well, I'm more than happy to be born in this generation. Hopefully, I'll be able to live much longer. Much, much longer than my parents. So—

Aubrey de Grey 18:32
Hey, screw that your parents are probably younger than me. All right.

Sufal Deb 18:36
Oh you'd be surprised, they're about the same age as you.

Aubrey de Grey 18:39
Well, I mean, I haven't given up—

Marvin Yan 18:40
Maybe not biomarker wise.

Aubrey de Grey 18:42
I have not given up hope for myself so maybe I can fix your parents too.

Sufal Deb 18:46
Okay, perfect. Okay, I'd love to see them live—

Marvin Yan 18:48
You let them know Sufal.

Sufal Deb 18:49
I'll let them know.

Marvin Yan 18:50
After this.

Sufal Deb 18:51
Okay, so I'm going to jump ship a little bit. We've heard you mentioned before, the seven deadly sins of aging so could you give us a brief explanation on that and why it's commonly referred to as the hallmarks now, the hallmarks of aging?

Aubrey de Grey 19:02
Right. Yes. Hallmarks was a good word to use and very clever marketing by the people who wrote the paper in 2013 because it spoke very powerfully to the rest of the wider biomedical community, not just the community who study aging. The reason it did so was because it echoed a paper that came a number of years prior about cancer called *The Hallmarks of Cancer*, which, again, was very seminal,

a very influential paper. I didn't think of that. Basically, the thing I really want to focus on here is not the differences between what I wrote in 2000 or 2002 and what they wrote a decade later because what I really want to focus on is the similarity.

The fundamental paradigm, the fundamental concept that was being communicated by both myself and this late paper was the same thing. The idea that we want to repair damage, not just slow it down and the idea that having made that decision, we have to treat it as a divide and conquer strategy, something where we need to have a bunch of different therapies for addressing different types of damage that are all applied to the same people at the same time. That's the really the key thing that matters. Now if you look at the individual specifics, you can definitely find differences. In fact, even though they've got nine and I only had seven, you would be wrong in inferring that they identified things that I overlooked. It was actually the other way around. It was a different way of doing the partitioning. I still prefer mine. Surprise. I mean, the fundamental concept is the same and many of the things were identical like senescent cell removal, for example. The others are as good as identical.

Sufal Deb 20:43
Okay, perfect. Do you mind describing the seven deadly sins for our listeners out there?

Aubrey de Grey 20:47
Oh, sure. So obviously, I will describe my seven not the whole bunch.

Sufal Deb 20:51
Yeah, your seven of course.

Marvin Yan 20:53
Your seven, yes.

Aubrey de Grey 20:54
First of all, let me just say one generic one more generic thing, which is my seven has been defined, because of what they translate into in terms of repair modalities, the strategies that can be used to repair. Essentially, the motivation for having a set of types of damage be grouped together within a single category is if the ways to repair them are more or less the same and similarly, for not doing so. For example, two of my categories are with regard to waste products that accumulate in the body and they map onto only one of the hallmarks. The reason I use two is because the division I make is between waste products inside the cell and waste products outside. The two ways that I have been recommending ever since 20 years ago for how to repair those things are very different for the two cases. Essentially, in the case of extracellular aggregates, you can use the immune system. You can vaccinate against it and that really works already, at least in some cases. In the case of stuff inside the cell, you need to introduce foreign enzymes. I'm interested in bacterial enzymes that are particularly good at doing things that we do not have the genetic capacity to do. So those are two of my categories.

Then the other thing that happens inside the cell that I think we absolutely need to address, and again, this was also a hallmark, is mitochondrial mutations. The mitochondrion is this place where the chemistry of breathing happens, where cells combine nutrients with oxygen in order to extract energy from the nutrients that can be used for everything else the cell does. Mitochondria have their own DNA, they're the only part of the cell the cell that does outside of the nucleus. It turns out that's a spectacularly bad place for DNA to be because the process of extracting energy from nutrients actually creates toxins, free radicals, and they damage DNA. We've been trying to fix that by essentially putting backup copies of the mitochondrial DNA in the nucleus. We are pretty close to getting that working, far closer than anyone else ever believed was possible so that's nice.

Then there's another type of damage outside the cell. I already mentioned waste products but another thing that happens is stiffening, loss of elasticity. What matters here is the lattice of proteins called the extracellular matrix. This is a bunch of proteins that are secreted by cells, and then they are deliberately linked together in a very regular array and that regularity gives elasticity to the relevant tissue. For example, the artery wall needs to be elastic, major artery, because it needs to buffer the heartbeat and it has a place in energy saving. When the artery becomes stiffer, the heart has to pump harder, because energy gets lost in the process. That's a big contributor to hypertension in late life, which of course has many knock-on effects.

The way to fix that is to essentially reverse the chemistry that's gone on. The stiffening arises from largely the chemical reaction of the amino acids in the extracellular matrix with sugar in the circulation. That sometimes causes new covalent chemical bonds between proteins that are not supposed to be linked together. We want to break those bonds. Those bonds have a very distinctive chemical structure so this is not as crazy as it sounds. Indeed, our work on that has already gone to the point of being spun out in the company, as has actually some of the work on eliminating waste products that I mentioned earlier.

Then the other things that we addressed— I've dealt with two things inside the cell and two things outside the cell so far. The other things are all about the number of cells. There are two ways of having an excessive number of bad cells. One of them is very obvious to everybody. It's cancer cells that divide when they're not supposed to and eventually take over and cause us to die. We are addressing cancer in number of ways but we're particularly interested in telomere-based approaches that essentially cause the cell to kill itself by virtue of the mechanism that it uses to allow itself to be able to divide indefinitely in the first place. That's going quite nicely. Again, there's a company pursuing the most promising approach to this so **[inaudible]** we can move into clinical trials.

The other one, which is also quite high profile, most of you in the audience will probably have heard about it are senescent (??) cells which is a slightly poorly defined category. Basically, it means cells are not dividing, they're not doing anything else either. They're sitting there and not doing some of the things that they were built to do. In particular, worse than that, they are secreting stuff into their neighborhood that is bad for other cells, including actually **[inaudible]** by the cells. It's important to get rid of those and a number of companies have emerged over the past five years or

so that are doing very nicely in selectively eliminating those cells. That's two types of having too many cells.

The final seventh type of damage is having too few cells of a good type. This is particularly in relation to stem cells, or at least in particular, to the inadequacy of stem cell replacement of cells. For example, Parkinson's disease is an example of this. There's this one part of the brain, the substantia nigra, where you have a particular type of neuron, a dopaminergic neuron. These neurons create dopamine, that's why they get their name. Dopamine is a really important neurotransmitter. For boring chemical, biological reasons. dopaminergic neurons die much more rapidly than other neurons do and so by the time of old age, all of us have lost maybe a quarter of the ones that we had when we were 20.

That's okay because there's that much slop in the system. So that's fine. Unfortunately, as with everything in aging, some people have a certain type of damage accumulating a bit faster than other people. Sure enough, there are some people who have lost by old age maybe three quarters of their dopaminergic neurons, and that means they get Parkinson's disease. The natural way to fix this is to put stem cells into the substantia nigra that will divide and differentiate to replace those lost neurons since the body is not doing it on its own. Indeed, that was already a very promising treatment in clinical trial. So those are the things.

Sufal Deb 27:28
Okay.

Marvin Yan 27:29
Wow, that's a good summary. To follow on that, because it seems like that progress is going pretty well, at least as expected, Sufal and I would love to be able to invest in some of these but unfortunately, we are university students, and our income currently is very low. We don't have as much money as Sergey Young, unfortunately. For people who are listening because a lot of our listeners are of a younger audience, say they really want to make a difference in the field of longevity in their next— spend the rest of their 20, 30 years. What would be the best way to do that?

Aubrey de Grey 28:00
Okay, the first thing I really want to emphasize is that there is absolutely no one best answer to that. Every single person has a particular circumstance that they're in, particular skills they have, that defines how they can make the most difference. Nothing that I say in terms of recommendations for how to make the most difference should be taken as a generalization. Okay? Except for one thing. One thing is this. You were pointing out how you don't have resources because you're only college students. I always like to point out that the poorer you are, the more people you know who are wealthier than you. Of course, my point here is that everybody can do advocacy.

Everybody can talk to their friends or family, their colleagues, and educate them on this. Because at the moment, by no means have we won the advocacy battle at all. We still have a huge way to go and that the overwhelming majority of humanity have decided to put aging out of their minds, and to regard it as not their problem, or at least not a problem that worth thinking about. That is slowing

things down astronomically. Every little step of the way of persuading somebody that actually this might be quite important, it's not science fiction or whatever, makes all the difference. I want to emphasize it's not just a matter of taking someone who's already pretty positive about it, and getting them that little bit over the edge so that they are sufficiently positive to actually write me a check. No, it's not only that.

That's important but it's also important to do the other end of the spectrum, to take people who are vehemently opposed to this and say that aging is a blessing in disguise and death gives meaning to life and all that fucking bullshit and get them to at least be embarrassed to think such things and not say them too loudly. Because then you get other people donating. For example, this is a fact, I tell you I have multiple examples over the past decade of very wealthy people that I know, who really want to financially support this work and who know that they would make a difference if they did but they have never done so. They haven't done so because their wives have told them not to. It's the honest truth. It's terrifying. It's terrifying, but it's how it is.

Of course, we have some way escaped this at SENS Research Foundation by being an independent charity. By at least being funded almost entirely by philanthropy. Yes, we have the problem I've just described but at least we don't have the much bigger problem of having to sell ourselves to peer review and get funded by the government or funded by investors necessarily. We're far more free and that's a huge part of why we've achieved as much as we have.

I should probably give a slightly broader answer to a really important question. What can people who are listening to this podcast actually do? Of course, people that are 20, you haven't really decided what you're going to do with your life but you may have some impression of what you're good at. If you find that you're really good at the bench, you could do experiments. We're never going to have enough people like that. Some people aren't really good at doing experiments reproducibly and getting results that we believe. Some people with how ever hard they try, they just are not those people. Find out how good you are at that, that kind of thing. Of course, doing what you're doing right now, exposing people like myself to new audience, getting the word out that again, a lot of people, young people can do that. I do interviews like this every other day but I'm not the only one anymore. I used to be. There's more of us out there doing this. Still, we need more saturation, we need saturation coverage of this method.

Sufal Deb 31:56

Yeah, I was just going to say earlier, I remember listening to another podcast and you mentioning how when you first started organizing conferences, you would reach out to people and they would say, oh, I don't focus on aging, and they're in some other form of science. We experienced that a lot because our projects goal is to reach out to various fields and bring them into aging, ask them questions regarding it. A lot of them responded the same way where they're like, oh, I don't do aging. I don't think I'm the right fit for you. While we just were on the topic of wealth, say we had a couple thousand dollars burning holes in our undergraduate pockets. Where should we put it? I know you've said you're not a pro investor or anything. Where should we look towards?

Aubrey de Grey 32:31

It's really hard these days. I mean, of course, the thing that makes the highest of all is the rise of crypto. We have an enormously strong following within the crypto and blockchain community and that's fantastic. We've had a lot of donations from them over the past few years. I haven't the fain— I mean, I'm not a betting man. I just haven't the faintest idea how to do that myself. Anyone who fancies their chances of making proper money in the crypto world? It's definitely something to try. It's the quickest way to make money if you get lucky.

Of course, plenty of people can get unlucky but the whole point like with any investing is, the more you pay attention, the more you can do better than the average of the markets. Again, I'm not advising this as a general case. Obviously, don't do it unless you really have reason to think that you could be really good at it. But people can multiply their money faster than by any other type of investment. Other ways to use $2,000? Well, I mean there's an awful lot of ways. I mean, the way I just mentioned, its not nothing. Just getting yourself in front of a camera, getting me in front of a camera, all those things you can do for not much money

Sufal Deb 33:57
Perfect.

Marvin Yan 33:59
So Sufal and I, we're based in Canada and as far as we know, I don't— I could be wrong. We haven't met a lot of professors who are really involved in this field. We have something called the Aubrey Scale, which is pretty much we go talk to a biology professor we want to work with, we ask them how much do they know about Aubrey de Grey, David Wood, David Sinclair, right and then we see their response. Sometimes it's like, oh, I've heard of them. Sometimes, it's like, it's not really my type of aging, though, right? We want to ask, what sort of countries are really leading the charge in terms of this field and are there certain countries that aren't really involved yet, but that really should be to make a huge push?

Aubrey de Grey 34:34
Excellent question. First of all, let me say something about Canada, specifically, because you're quite right that Canada is not exactly overflowing with PIs [Principal Investigators] who are being outspoken about this, but it is overflowing with other types of persons within the longevity movement. I have never understood this to be honest. I've been saying for 15 years how remarkable it is that there are three categories of people who are ridiculously overrepresented within the longevity movement. Two of them make perfect sense. One of them is IT [Information Technology] people. I'm an IT person originally, right? It just seems like this way of thinking is easier to get one's head around it if one's got that kind of education. The other one is libertarians, who are— they're happiest when they're doing something that other people think is crazy, right? The third category is Canadians. I mean, what the f*ck? I have no idea.

This has been true for a very long time. I'm one of the people who can really take pride in how much they put their head above the parapet. Way before I came along, in other words, when it was even more unacceptable, was Michael Rose, who is a professor in California now, has been for a long time, but he's Canadian originally. The number of the people who have been prominent in cryonics

as well have been from Canada. A number of the people who work for me, including my co author of my book, Michael Rae, he's from Calgary, originally. One of my board of directors, Kevin Perrott is from Edmonton. There are people all the way across from British Columbia all the way to the Newfoundland, who have been really doing worthwhile stuff.

In Toronto, that was the origin of Kristen Fortney, who is the CEO of one of the most successful longevity companies right now, BioAge, again based in Silicon Valley. Then Moses Znaimer. Don't know if you've heard of him, he's probably 80 now. He shot to fame for creating the first Canadian porn channel if I'm not mistaken, but anyway, he's a TV mogul, and quite a wealthy guy. He runs a conference every year called ideacity, which you can look up. I've spoken there a number of times, he's very heavily into all this, he actually created a Canadian counterpart of the AARP, which you can look up. Yeah, I could go on. Lots and lots and lots of people. One of the professor's we fund right now, based in New York is from Montreal originally. Yeah, I don't get it but that's how it is.

You can't really say there's a particular country you should work in. Absolutely, willingness to speak freely about the desirability of actually doing something about aging is very much a metric that it makes sense to have for you, for people who want to decide where to study. It used to not be. It used to be that even people like David Sinclair, could not say things that might get repeated but that's not really true anymore. People now are willing to step well outside of that box and acknowledge that longevity is a medical problem. Sorry, I mean, aging is a medical problem. Longevity is the medical goal and it's okay for youngsters to think so.

Marvin Yan 38:09
I know you've answered this one a lot Aubrey but I feel like it comes up a lot when I tell people that I'm interested in aging, because they usually think geriatrics and I have to say, not really that but sort of explain it. They usually come up with the arguments of well we shouldn't end aging because any number of arguments from overpopulation, there's a dictator who is going to live for a thousand years, or pollution, stuff like that. Could you just very briefly sort of summarize why these arguments are— whether they're good, bad, or what your opinion is on them?

Aubrey de Grey 38:40
You asked me to give a brief answer—

Marvin Yan 38:41
Oh, no.

Aubrey de Grey 38:42
But let me explain first of all, why I could give a long answer. Which is, of course that each of these individual reservations and concerns is a priori not completely stupid. I mean some of them are, death gives meaning to life, that's just stupid, right? Where will we put all the people, or won't **[unintelligible]** forever, or how we pay the pensions, these are not stupid. These are things that legitimately occur to people. Therefore, it is important to come up with really good answers to them. They are definitely misplaced concerns, but you have to actually know what to say.

For example, one thing that pisses me off royally is that a lot of the people in the longevity movement... When people say, oh dear, where will we put all the people? They'll say, don't worry, we'll go into space, we'll mass emigrate. Now, first of all, that's mathematically idiotic because how much space when you get to an X amount of time exponential functions overtake binomial functions, you probably know that right? It's much worse than that. The real problem is hardly anybody wants to go into space. Duh! Therefore, if you say, that's the thing that we're going to do to solve the problem, then not only will they say, well, I don't like that solution, but they'll also completely disregard everything else that you say thereafter that might be sensible, because they'll think this guy doesn't understand real people. Right? Never say that.

The real answer, of course, is that overpopulation is not a problem with enough space. It's a problem of pollution, and we're fixing that already with renewable energy and so on and so forth. Anyway, to come to the brief answer that I said I was going to give, the key point is to bring all of these concerns together and embarrass the person you're speaking to into having a sense of proportion. You have to ask them not are these potentially concerns. You also have to ask them, not if they are confirmed, can we address them, can we avert them? Well, you have to ask them as even in this arbitrarily implausible worst-case scenario where we can't stop this and where, for example, we actually end up in the future having to make the choice between having fewer kids than we would like, or letting people get Alzheimer's disease, what are we actually going to choose for God's sake?

The problem of aging today is not just an economic problem. It is an astronomical economic problem. It is unequivocally the source of by far the largest amount of suffering in the world. Just because we have become fairly good at putting it out of our minds, using all manner of psychological tricks, doesn't stop that from being the case. We actually have to say to ourselves, if we had the choice, if hypothetically, we did have the technology to not get biologically old, would we use it or would we prefer it even if we had the other problems that resulted in a consequence. Nobody ever succeeds in coming up with an argument that says that the population problem or the dictators problem, whatever, will actually be worse than the problem we have today, where we're **[unintelligible]** objectively. That's the thing that I feel should be focused on by everybody who wants to get people at least to be less opposed to this crusade.

Sufal Deb 41:38

After talking for over 40 minutes, is there one thing for all of our listeners to take away from today? What exactly should they take away from this conversation?

Aubrey de Grey 42:19

I would say the fundamental thing to take away is that there is no biological meaningful difference between the things that we call age-related diseases, and the things that we call aging itself. That terminological distinction is only terminological, it's purely semantic. It's massively damaging, because it is a gateway drug to allowing people to number one, try to address the so-called diseases of aging with by methods that are never going to work if there were infections, so I've explained the geriatrics approach earlier. Number two, it allows them to trick belief that the things they classify under aging itself, are so different from diseases that they are kind of off limits to medicine, and we shouldn't even be trying to fix that, because aging is natural, and inevitable and universal, and all

that kind of stuff. People can take away the fact that it's all aging. Its just some parts of aging, we've chosen to give disease like names to them and some we haven't. It's all aging, it's all a consequence of the accumulation of damage throughout life and if we fix the damage, we fix both of these completely indistinguishable components of aging and that will result in indefinite health, enormous alleviation of suffering, also enormous increase in prosperity.

Sufal Deb 43:26
Where can people learn more about your work, support it or even get involved with aging in general?

Aubrey de Grey 43:32
Sure, yeah. Of course, I recommend our website sens.org. "S" for September, "E" for elephant, "N" for November, "S" for September. It doesn't have an "E" at the end. It is the place to go what whoever you are, we have material that experts and also for everyone through to complete novices. We have obviously lots of news about what we're doing, where I'm speaking, things like that, and also what other people are doing. We have a very good newsletter that you can sign up for and of course, there's a nice big friendly donate button and even if you're a student with no money your father, your grandfather may think differently.

Marvin Yan 44:06
For you guys listening, the links to what Aubrey just said will be below. Once again, thank you, Aubrey for coming on. We appreciate it. This is you guys listening to I'm a Mortal, which is your source for all things immortal. That's it for today Aubrey. Thank you so much.

Aubrey de Grey 44:18
Thanks for having me.

[MUSIC - Im a Mortal Theme]