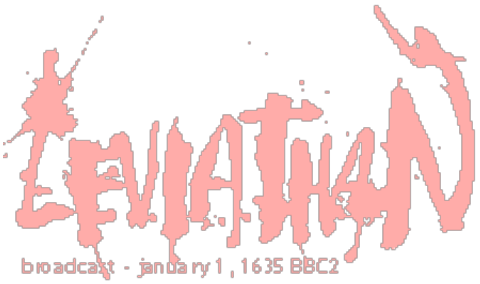


**Lee Silver,**
Geneticist

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**Q: What is the future for genetic engineering in humans, is there a positive side to it?**

A: Genetic engineering is now a fact in animals and plants. We can do it in a highly efficient way with mice and sheep and pigs and crops and other things, that tells us that's there's no barrier to stop us from doing genetic engineering of human beings if we wanted to.

People say, well it's dangerous, and that's true right now, but it will be possible to develop the technology so that it could be used safely on human beings, and then the question is should we do it? And before we can answer that question, we have to understand what we mean by "we". The question is should individual people be allowed to give advantages to their children, versus should society stop people giving advantages to their children.

**Ultimately you could end up with human beings splitting into two different groups of people who can actually no longer breed with each other.**

So what might parents want to do for their children, realistically? I think parents will want to give their children genes that protect them against cancer and heart disease and Altzheimers disease and you can imagine all sorts of benefits that parents would want to give their children genetically, if they could.

The problem is that the technology is expensive and might only be affordable to those who have money and not to those who don't have money, so it could greatly increase the gap between haves and have-nots.

**Q: Can we talk now about your scenario for the development of two species and how that's brought about simply by people wanting the best for their children?**

A: Only those in the monied classes will be able to use the technology to give their children genetic advantages. Genetic advantages can be transferred down from one generation to the next, and the children can add further genetic advantages into their children and that generation could add further genetic advantages into the next generation.

**It's very difficult to prevent development in science. It's like saying that we should have stopped physics at the beginning of the 20th century because it led to nuclear weapons.**

What you could have is a group of wealthy individuals, who right now are only different in their social class from other people, having a line of descendants who became genetically and genetically further and further apart from those who cannot afford this technology. Ultimately you could end up with human beings splitting into two different groups of people who can actually no longer breed with each other, at which point they would be different species.

**Q: How do you envisage those two different species inter-**

**relating?**

A: The problem here is that we're going into a world that is going to be totally different than the world we live in today because there really are no limits to what we can do genetically.

Anything that I can imagine in terms of changing genes in a baby, I could do. I could give a baby the hearing ability of a dog or the eyesight of a hawk. I could give that child anything, resistance to diseases of all different kinds, and further in the future, as we understand more and more about the human genome, we'll be able to increase that child's intellectual potential. All of a sudden you'll end up with a group of children who are born, who are vastly superior at the genetic level to what I call the naturals, those people who have not had genetic enhancements.

**"I don't think that anybody is going to willingly give up their body to become part of some larger electronic life form."**

I don't think those people would be able to interact very well and so they will stay apart from each other socially and ultimately they won't be able to breed with each other. That's exactly the way that new species get formed in nature. This I think is actually quite horrible. I think it's going to be a disaster because one group of people who is a different species to the other group of people will no longer have the desire or need to treat that second group of people with dignity and respect. And I think that's a pretty bad outcome although I don't see how we can stop it from happening.

**Q: And so you would say that this is a serious possibility, almost a certainty?**

A Every single geneticist practising in the world today has to tell you that the genetic engineering of human beings is a technical, not only a technical possibility but it can be done, and the only question is whether or not people will do it.

Some people, some geneticists think that somehow government or society can stop people from using this technology. I don't believe that's going to be possible, because I think it goes to a basic desire that we have to give our children advantages and I think that basic desire and the fact that we live in a global society is going to make this technology happen. Some people with money are going to want it, they're going to find other scientists who are going to give it to them.

**"I think there's no question that within a hundred years from now we will be able to replace human organs with spare organs that we grow in the laboratory."**

**Q: So it would be better if we'd prevented all this kind of development in science?**

A: It's very difficult to prevent development in science. I don't think genetics was developed toward this goal. It was developed from very good goals of trying to overcome disease and make people as a whole happier. This is an outcome that was not expected. It's like saying that we should have stopped physics at the beginning of the twentieth century because it led to nuclear weapons.

**Q: Do you see the possibility of increased longevity? Is that a positive thing?**

A: The question of whether increased longevity is a positive thing depends on which perspective that you take. Each individual person would like to live a long happy life, as long as they are mentally intact. For society as a whole it might not be positive but at the individual level it is positive, that's what we all want to be able to enjoy life.

I don't see a problem with increased longevity as long as we can control the population of the world, and if the entire world becomes industrialised, and all families in the world only have two children, there won't be a problem with increased longevity.

**Q: What about ideas of the interface between man and machines and that kind of thing? Is that something that you see as a possibility for our future?**

A: There are many scientists, especially computer scientists, who think that we might eliminate organic life and become electronic life instead, and that we might merge machine and human together. I don't think this because from an evolutionary perspective we have this ingrained desire to want to have children and we want to be individuals. We want our children to be individuals, to have further children. I don't think that anybody is going to willingly give up their body to become part of some larger electronic life form.

**Q: In 2100 will we be growing ourselves spare parts?**

A: I think there's no question that within a hundred years from now we will be able to replace human organs with spare organs that we grow in the laboratory.

Either we'll do it by growing human cells in the laboratory or by genetically engineering animals so that their organs can be placed inside of a human being without being rejected. There's no question that by the year 2100 we will be replacing all the organs in our body except one. We can never replace our brain because our brain is who we are.

**Q: So you don't see any kind of issue revolving around where the soul resides?**

A: I don't think there's any, any reasonable philosopher who would suggest that the self resides anywhere except in the brain. We don't understand how the self resides in the brain but we've already done heart transplants and liver transplants and lung transplants, and that technology allows people to live longer and that technology is going to be expanded and perfected.

**Q: Taken to the extreme, does that mean you could transplant your brain into a whole new body?**

A: Taken to an extreme, it is conceivable that you could put your brain into a whole new younger body. What we can't think of or see how to do right now is prevent the brain from decaying. I mean the brain isn't very good if it's functioning at a lower level, like in an Altzheimer's disease, the patient for example. But I think we'll be able to figure out ways to overcome Altzheimer's disease and many other forms of senility, so I think we'll be able to push the productive lifespan much further along that it is today, at least to 120 years.

**Q: What would be your most far-fetched scenario?**

A: It is clear from our understanding of genetics in other organisms as well as in human beings that there really are no limits to what we can do genetically and we are programmed right now to die. If we can understand the programme that makes us die, usually before the age of 100, and correct that programme in the embryo, we'll be able to have children born who can live essentially for ever. And I think that probably will

**I think we'll be able to push the productive lifespan much further along that it is today, at least to 120 years.**

**Would people really want to live for hundreds of years? Or will they reach a point where they just say 'I've lived long enough, I give up'.**

happen at some point in the future.

**Q: And how would that affect the way that you live your life? What questions does that raise for you?**

A; Well there's a very interesting philosophical and psychological question as to whether people would really want to live for hundreds of years or will they reach a point where they just say 'I've lived long enough, I give up'.

**It is conceivable that you could put your brain into a whole new younger body.**

I can't imagine myself saying that and there are many other people I know who I can't imagine saying that either. Perhaps some people will say that and they will give up but other people will go on productively for hundreds and hundreds of years.

The only question in my mind is how soon that will happen. Will that happen during the next century or will it happen a thousand years from now? I don't know the answer to that question.

**Q: Looking back on 2000 in 2100, what will be the things that you find must peculiar about the way we live now?**

A: I am absolutely convinced that when people look back at the year 2000, they will laugh at all of those who were against biotechnology like so many people are in the world today. Just like we laugh at the people 200 years ago who were against the vaccine that was invented by Jenner.

People thought the vaccine was horrible anti-nature. A hundred years from now people are going to realise that biotechnology can bring good things to their lives.

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