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Chasing Immortality
The Technology of Eternal Life:
An Interview with Ray Kurzweil by Craig Hamilton



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The Mission of *What Is Enlightenment?* magazine

What Is Enlightenment? is dedicated to a revolution in human consciousness and human culture. Guided by the always-evolving vision of founder Andrew Cohen, whose tireless passion for spiritual inquiry continues to push the edge of contemporary thinking, we are in search of a radical new moral and philosophical architecture for twenty-first-century society. We believe that finding this framework for transformation—rooted in the timeless revelation of enlightenment, reaching toward a truly coherent ethics for the postmodern world—is imperative, not only for the evolution of our species, but for our very survival. By asking the hard questions of the new science and the ancient traditions, of art and culture, of business and politics, *What Is Enlightenment?* seeks to create a dynamic context for conscious engagement with the greatest challenges of our times, a groundwork for the ongoing liberation of human potential.

Chasing



The Technology of

DO YOU WANT TO LIVE FOREVER?

Immortality



Eternal Life: An Interview with Ray Kurzweil by Craig Hamilton

The allure of eternal life has been tugging at the human imagination since we first began to contemplate our finitude. From the Epic of Gilgamesh, the oldest known literary work on earth to the Taoist cult of immortality to Ponce de Leon's quest

for the elixir of unending youth, the desire to free ourselves from the Grim Reaper's grasp has proven as persistent as the force it aspires to counter. But although we may have been inspired to hear of Himalayan yogis who have been alive for centuries and although our collective obsession with health, fitness, and increased longevity seems to be at an all-time high, at the dawn of the twenty-first century, even the most optimistic among us have probably never seriously considered the possibility that death could become optional. Indeed, in an increasingly chaotic and unpredictable world, it sometimes seems like our mortality is one of the few things that we can still be sure of.

Ray Kurzweil is determined to change all that. In the book he recently coauthored with Terry Grossman, *Fantastic Voyage: Live Long Enough to Live Forever*, the award-winning inventor and futurist lays out a vision of "the science behind radical life extension" that makes most science fiction writers seem short on imagination. And he's not alone. Over the past few decades, a growing body of research into the aging process has been accumulating in laboratories around the world. And among the more ambitious of the scientists involved, there is, believe it or not, an increasing optimism about the potential of actually bringing the seemingly irreversible mechanisms of degen-

eration and decay that have haunted humanity for millennia to a screeching halt. Soon.

How soon? According to Kurzweil, two or three decades looks like the magic number. And for him, and other aging boomers, the million-dollar question is: Will he be around and in good health when the fountain of youth finally starts flowing? This is where the subtitle of his book comes in. Living "long enough to live forever," it turns out, may require a bit more than simply eating your vegetables and not smoking (although that's definitely a start). For Kurzweil, building the "first bridge" to radical life extension means a radical shift in diet, a heavy supplementation regimen (he takes 250 supplements a day), and regular checkups and rejuvenation treatments to slow the aging process as much as possible using today's technology (and, of course, regular exercise and low-stress living). But even Kurzweil's "longevity program" is, he admits, only a modest stay against the inevitable. With a little luck, though, it will be enough to keep him kicking until the "second and third bridges"—biotechnology and nanotechnology, respectively—emerge to secure him his place in eternity.

Are human beings really ready to live forever? Do we have the psychological and spiritual resources to deal with such a profound shift in the very fundamentals of our existence?

What would a person be without the confrontation with mortality that has defined life and culture as we know it? And as much as we all run from death, are we sure that doing away with it would be a good thing? What would become of the first species to break the death barrier? When confronted with a prospect as radical as immortality, questions like these start to beg for answers. And given the possibility that we might actually be the first generation in history with the luxury of having to ask them, there are many who feel that we might do well to give them some thought before we proceed much further down the road to Shangri-la.

But that isn't stopping Kurzweil. Nor does it appear to be slowing him down. Widely regarded as one of today's leading futurists and innovators (winner of the prestigious National Medal of Technology, his inventions include the first reading machine for the blind and the first synthesizer to duplicate the sound of a grand piano), his unbridled enthusiasm for the omnipotence of technology to surmount any obstacle it confronts has him ready to embrace whatever the future may bring. If even one-tenth of what he predicts comes true, it will be the end of life—and death—as we've known it.

Our aim is

WHAT IS ENLIGHTENMENT: In your new book, you assert that in the not-too-distant future, we'll have the capacity to extend the human life span indefinitely. How long do you think we can expect to live?

RAY KURZWEIL: One analogy that life extension researcher Aubrey de Grey uses is, "How long does a house last? If you take care of the house diligently, and quickly address any problem that comes up, the house can last indefinitely. If you don't take care of it, it won't last very long." The reason that analogy fails in regard to our own bodies is that we don't yet understand all the methods and we don't have all the maintenance tools for our bodies like we do for houses. We fully understand how a house works, because we engineered the concept of a house. We don't yet have all that information about our bodies and brains, and we don't have all the tools. But we will have them within twenty to twenty-five years, so we will be able to indefinitely maintain our bodies—and even anticipate, before they occur, the kinds of issues that now cause us to age and die. We're talking about putting your life into your own hands rather than leaving it in the metaphorical hands of fate.

WIE: How is science going to bring this about?

KURZWEIL: Terry Grossman and I have described what we call the "three bridges" to radical life extension. Bridge one has to do with taking full advantage of today's knowledge of biology in order to dramatically slow down aging and disease processes. This will enable us to stay in as good a shape as possible for when bridge-two technologies become available. Bridge two is the biotechnology revolution, which will give us the tools to reprogram our biology and the biochemical information processes underlying our biology. We're in

nanotechnology revolutions come to fruition. Our aim is to live long enough to live forever.

WIE: You've been following your own "bridge-one longevity program" for several years now. Do you have any indications that it's working?

KURZWEIL: When I was forty, I took these biological aging tests that measure forty or fifty different biochemical indicators, and I came out with a biological age of about thirty-eight. I'm now fifty-seven, and last year I came out at forty, so I've only aged a couple of years in the last sixteen years. That does reflect how I feel and look. I've overcome a major predisposition to diabetes—I was actually diagnosed with it twenty-two years ago, but as a result of using basically natural methods to reprogram my biochemistry, I now have no indication of it. I also had a predisposition to heart disease. My father died at fifty-eight of that disease, but I've never had it. So I have a completely different biochemistry than I would otherwise have.

WIE: Can you give an example of what you mean by bridge one, of how we can extend the life span using our current medical knowledge?

KURZWEIL: One aging process that we can control right now has to do with the loss of phosphatidylcholine in our cell membranes. The cell membrane is typically sixty percent or more phosphatidylcholine in a young person, but it can be down to ten percent in the elderly, in whom it gets replaced by useless substances like hard fats and cholesterol. It's one of the reasons that the skin of an elderly person is not supple

to live long enough to **live forever.**

the early stages of that revolution already, but in fifteen years we will have, to a large extent, mastery over our biology. That will take us to the third bridge, the nanotechnology revolution, where we can rebuild our bodies and brains at the molecular level. This will enable us to fix the remaining problems that are difficult to address within the confines of biology and ultimately allow us to go beyond the limitations of biology altogether. So the idea is to get on bridge one now, so we can be alive and healthy when the biotechnology and

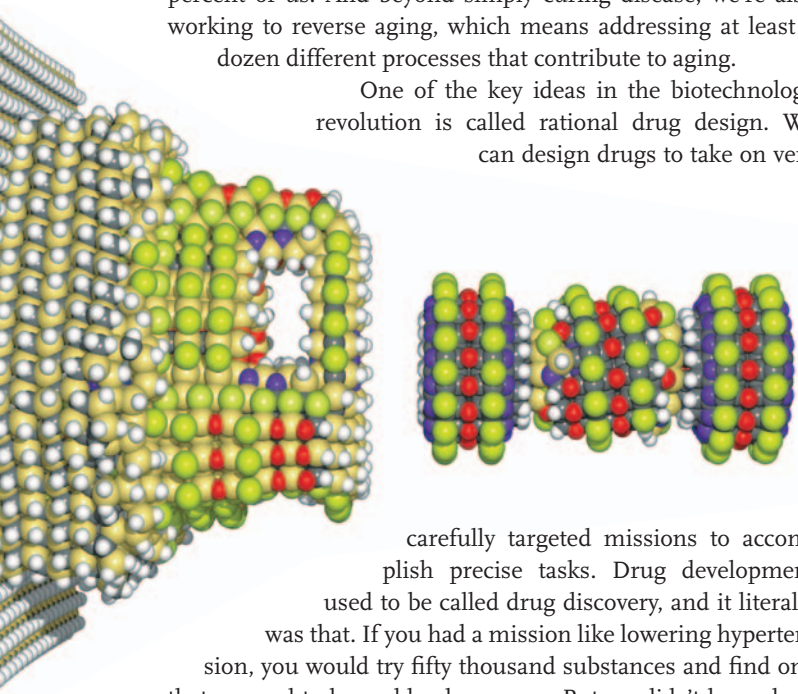
and their organs don't work as efficiently. The body makes phosphatidylcholine, but it does so very inefficiently, so gradually over the decades, our cell membranes are depleted of that vital substance. You can reverse that by supplementing with phosphatidylcholine; that's one of the 250 supplements I take. The objective is to use these bridge-one methods, which is applying today's knowledge aggressively so that

we can be in good shape as the new technologies in bridge two, the biotechnology revolution, become available in another fifteen years.

WIE: How is biotechnology going to aid in life extension?

KURZWEIL: Through biotech, we're developing the tools to reprogram our biology at the most fundamental level—the level of biochemical information processing. We're not far from being able to overcome diseases like heart disease and cancer, type 2 diabetes, stroke—the major diseases that kill ninety-five percent of us. And beyond simply curing disease, we're also working to reverse aging, which means addressing at least a dozen different processes that contribute to aging.

One of the key ideas in the biotechnology revolution is called rational drug design. We can design drugs to take on very



carefully targeted missions to accomplish precise tasks. Drug development used to be called drug discovery, and it literally was that. If you had a mission like lowering hypertension, you would try fifty thousand substances and find one that seemed to lower blood pressure. But we didn't know how it worked or why it worked, and invariably, because it was really a very crude application, it would have all kinds of side effects. Whereas now, we can actually understand these processes very precisely in biochemical terms—for instance, the whole sequence of information processes that occur in the development of something like atherosclerosis, the source of heart disease—and we can attack them at specific vulnerable points. For example, there's one enzyme in the body that destroys HDL, the good cholesterol. If you inhibit that enzyme, people's HDL levels soar and it stops atherosclerosis. There's a drug now in phase-three FDA trials, torsotrope, that does exactly that, and it looks very promising. I wouldn't hang my hat on any one specific development, but there are thousands of these.

We also have the means now to inhibit gene expression.

That's very important because every major disease—heart disease, cancer, diabetes, and, of course, viral diseases—uses gene expression, and if we can inhibit certain carefully selected genes, we can stop disease. There's a new methodology, RNA interference, where we put small RNA fragments into a medication that goes into the cell and blocks the messenger RNA expressing a gene and then blocks the expression of that gene. It works very well.

There are lots of genes we'd like to inhibit. One exciting example is the fat insulin receptor gene, which basically says “hold on to every calorie, because the next hunting season may not work out so well.” You have to remember that our genes evolved tens of thousands of years ago, when conditions were very different than they are today. There wasn't any evolutionary reason for people to live very long, because once you were done with child rearing, which was generally maybe age thirty, you were using up the limited resources of the clan. And so longevity was not selected for. But there were genes that were appropriate for the time, like holding on to every calorie, because calories were few and far between—unlike today, with our super-sized

We're talking about putting

meals. Now when scientists inhibited that gene in mice, those mice ate ravenously and remained slim—and they got the health benefits of being slim. They didn't get diabetes; they didn't get heart disease; they lived twenty percent longer. A number of pharmaceutical companies took notice and are now pursuing inhibiting the fat insulin receptor gene in fat cells, which would be quite a blockbuster concept. And that's just one of our twenty-three thousand genes.

So bridge two is already under construction, but in ten or fifteen years, we'll have the full fruition of that revolution, where we can really reprogram these information processes underlying our biology. And then twenty-five years from now, bridge three, the nanotechnology revolution, will enable us to go far beyond the limitations of our biology.

WIE: So even with all of the biotechnological innovation you're predicting, are there some limitations inherent in our biology that we won't be able to overcome without going beyond it?

KURZWEIL: Biology, while remarkably intricate, clever, and complex, is far from optimal, because biological evolution made various early design decisions that everything else has to be based on. For example, everything is built out of proteins, and

although proteins are three-dimensional molecules, they're a very limited class of materials with very limited properties. And we find time and again, as we actually reverse-engineer the methods of biology, that we can reengineer biological processes to be far more capable. For instance, our thinking takes place in the interneuronal connections in our brains. We have a hundred trillion of them, and they process information at chemical switching speeds of a few hundred feet per second, which is a million times slower than contemporary electronics. And that's based on the current speeds of today, when chips are still flat. Once electronics goes into the third dimension, they will be *far more* powerful. For instance, a one-inch cube of nanotube circuitry would be a million times more powerful than the human brain.

Or take our red blood cells, which are actually very simple devices—they just store and release oxygen in a certain fashion. There are already nanorobotic designs for robotic red blood cells that would do that hundreds of times more efficiently. If you replaced ten percent of your red blood cells with these respirocytes, as they're

that will be more like twenty to twenty-five years away. Once we have the full fruition of biotech and nanotech, we really will have the means to indefinitely forestall disease, aging, and death.

WIE: Leonard Hayflick, one of today's leading authorities on aging, has said that he thinks that people who believe we can engineer our own immortality don't understand what aging really is, that deterioration and decay are universal processes that apply to everything, biological or otherwise.

KURZWEIL: What am I? What is a person? I'm a pattern of matter and energy. I'm not this stuff that I'm looking at, because these particular particles were all different six months ago. We know that our cells turn over pretty quickly, and although our neurons persist longer, their constituent parts, the tubules and filaments, actually get turned over in days or weeks. Within a matter of months, all of the cells, or at least all of the systems within the cells, are changed. What persists is a pattern. I'd like

your life into your **OWN hands.**

called, you could do an Olympic sprint for fifteen minutes without taking a breath or sit at the bottom of your pool for four hours. Our biological systems are very sluggish. Take our white blood cells. I actually watched my own white blood cell in a microscope attack and destroy a bacterium, and it showed a measure of intelligence. It was very clever, but very slow; it was a boring thing to watch. It took about an hour and a half to complete that mission. Robert Frietas has nano-engineered designs that are fifteen to twenty years in the future, but once perfected, these designs would be hundreds of times more capable, would be able to download software from the internet that destroys specific pathogens including cancer cells, and would perform their mission in seconds rather than hours.

Now even though nanotechnology is largely in the future, there are already early adopter applications. For example, there's a blood-cell-sized capsule that's nano-engineered with seven animated pores that can successfully cure type 1 diabetes in rats; there are already sensors using nanotechnology that will be used in artificial pancreases to detect glucose levels with tiny computers embedded in the skin and to control the feedback loop. But the golden era of nanotechnology and the ubiquitous use of nanobots to augment the immune system and things like

to compare it to the pattern that water makes in a stream. When it's cascading around a rock, you can see a certain pattern, and that pattern can stay the same for hours or even months or years. But the water molecules that make up the pattern are changing within milliseconds. The pattern itself gradually changes as well—both the pattern of water in a stream and the pattern in our own bodies and brains—but there's a continuity even in this gradual change.

Now, Hayflick is correct that, left to their own devices, complex systems will eventually decay. On the other hand, you can intervene and modify those processes to maintain them. And it's not just a matter of fixing discrete problems, like saying, "Okay, there's a hole here. We'll plug the hole. There's a wound here, we'll plug the wound. There's a disease, we'll fix the disease." We do have to have more pervasive systemic interventions that maintain the integrity of this complex system. But that is something that can be done. We can do it with complex information systems, and we can do it with our bodies and brains.

One example will be DNA errors. If you examine the cells of an elderly person, you'll see there's a very high rate of DNA errors that have occurred. And that is the type of process that

Hayflick is referring to, because over time, those DNA errors cause a lack of integrity in this complex system. However, there are things you can do now to slow down DNA errors, and there will be biotech-based therapies to correct them. For example, I could take my skin cells and convert them into heart cells by manipulating the proteins in the cell body. I would discard those that had DNA errors or correct the DNA errors, extend

base pair of DNA in 2012?” or “What’s the spatial and temporal resolution of noninvasive brain scanning in 2014?” I could give you a figure that will be remarkably accurate. I have a track record of predictions based on these models, because these types of measures of information technology track in very smooth exponential progressions. We’re doubling the price/performance of information technologies each year—a factor

Psychologically, we’re not equipped to live

the telomeres, multiply them in vitro and reinject them, and a good portion would ultimately work their way into my heart. If I did this therapy repeatedly, every day and every week, then after a year, my heart would be ninety-nine percent rejuvenated cells. Even if I was seventy, I’d have the heart of a twenty- or twenty-five-year-old, and I would have corrected the DNA errors.

So there are many ways to restore the integrity of a complex system. And yes, we do notice the sort of gradual blurring of the integrity of the information in a complex system if it’s left to its own chaotic devices. But that’s precisely what we’re going to address.

WIE: Our current life expectancy is less than one hundred years. And our current life extension technology is nowhere near being able to do what you’re speaking about. In light of this fact, what you’re predicting sounds like an enormous leap in an extremely short time. What gives you the confidence that things will unfold in the way you predict?

KURZWEIL: We don’t have all the tools we need to extend longevity indefinitely at this moment, and if all science and technology were to stop, we wouldn’t be able to do it. But science and technology are not stopping, they’re accelerating. The future is always much more different than people anticipate because it grows not linearly but exponentially.

About thirty years ago, I became an ardent student of technology trends, and I began to gather data in many different fields and build mathematical models to predict future trends. And it turns out that certain things are hard to predict. If you asked me, “Will Google stock be higher or lower than it is today three years from now?” I could give you a guess, but that’s all it would be. If you asked me, “What will the next wireless standard be?” that’s also hard to predict. But if you asked, “What would one MIPS [million instructions per second] of computing cost in 2010?” or “How much will it cost to sequence a

of a thousand in ten years or a million in twenty years, which is really quite daunting. For example, whereas it took us fifteen years to sequence HIV, we sequenced SARS in thirty-one days. It cost twelve dollars to sequence one base pair of DNA in 1990, a penny in 2000, and it’s under a tenth of a cent now.

Another important observation is that we’re now at a point where we have the intersection of information technology and biology. We’re understanding life and death, disease and aging as information processes, and we’re also gaining the tools to change those processes—to reprogram the little software programs called genes that affect our lives.

WIE: Though we may fear death, and wish we could avoid it, most people have never taken the idea of immortality seriously. It seems that if such a thing were to become possible, it would be a change far beyond any change that has ever occurred in human history, with almost unimaginable psychological, social, cultural, economic, and spiritual implications. Is humanity ready for this kind of change?

KURZWEIL: Psychologically, we’re not equipped to live five hundred years. So if we were talking only about conquering disease and aging, and then just living on as human beings in our current form for hundreds or thousands of years, that would lead to a serious problem. I think we would develop a deep ennui, a sort of profound despair. We would get bored with the level of intelligence we have and the level of experience we have available to us. I think in order to make this viable, we need not only radical life extension but radical life expansion. We need to expand our intelligence and our capacity for experience as well, which is exactly what these new technologies will enable us to do. Then an extended life span would become not only tolerable but a remarkable frontier where we could pursue the real purpose of life, which is the creation and the appreciation of knowledge. And I mean knowledge in the broader sense, including music

and art and literature and science and technology and relationships. We're going to profoundly expand our ability to do that.

My next book, *The Singularity Is Near: When Humans Transcend Biology*, addresses the far-reaching implications for human life of these overlapping revolutions of genetics, nanotechnology, and robotics. For example, there are already

hardware of our brain crashes, the software dies with it. Our whole concept of life and death has those intertwined; they're not separable.

But we have already experienced a different type of reality where they *are* separable, and that's our software files. If you buy a new computer, you don't throw all your files away—your

five hundred years.

feasibility designs showing that we could develop solar panels and nano-engineered fuel cells that could convert sunlight efficiently enough to meet all of our energy needs. Nanotechnology will also enable us to create any physical product at virtually no cost from very inexpensive raw materials and information. And nanobots are going to be permeating our bodies, brains, and environment—doing our work for us, transforming our environment, cleaning up pollution from earlier eras, and vastly expanding our intelligence. As we merge with our technology, we will have billions or trillions of nanobots in our bloodstreams keeping us healthy, interacting with our biological neurons, and providing, for example, full-immersion virtual reality incorporating all of the senses. If you want to be in real reality, the nanobots will just sit there and do nothing. If you want to be in virtual reality, they'll shut down the signals coming from your real senses, replace them with the signals that you would be experiencing if you were in the virtual environment, and your brain will feel like it's in that virtual environment. You can move your virtual body there and have any kind of encounter you want, incorporating all of the senses.

But most importantly, this intimate merger of our biological intelligence with nonbiological intelligence will vastly expand human intelligence as a whole. I mean, once it gets a foothold in our brains, our thinking will really be a hybrid of the two, and ultimately, the nonbiological portion will be much more powerful, and may give us access to new forms of intelligence that are very different than anything we've experienced.

This also relates to longevity, because the reality of longevity for nonbiological systems is different than for biological systems. Right now, the software of our lives is the information in our brains. I estimate it to be thousands of trillions of bytes, which represents all of our memories and experiences and skills and just the whole state of our brain. So that's software, and it's inextricably tied up with our hardware. When the

files have a longevity that's independent of the hardware. Our lives are also information files, which I call our mind file. So eventually, the information in our brains will be independent of the hardware substrate that it's running on, just like software is today. That's the nature of immortality some decades from now, as our lives increasingly become dominated by the software of our mind file.

In envisioning the future, people frequently will take one change and consider how it would impact today's world as if nothing else is going to change. Most futurist movies are like that. In Spielberg's *Artificial Intelligence*, for example, you have human-level cyborgs, but everything else is the same—the coffee makers, the cars, no virtual reality. But you really have to look at all the different changes. If a very prescient futurist in 1900 had said, "We have a third of the population today working on farms, but I can see that will be less than two percent in a century from now," people would have said, "Oh my god, everybody's going to starve." But not only are we not starving, America's a major food exporter. How did that happen? Because new technologies, largely information-based, have improved productivity not only of food but of everything else.

WIE: Given our current struggles with overpopulation, many have pointed out that if such technologies were to become widely available, we would pretty quickly be faced with a choice between having more children and securing our own immortality. Do you agree?

KURZWEIL: I don't think it's going to be a problem. Yes, radical life extension will enlarge the population. But soon, all of our products and foods will be manufactured by nanotechnology replicators that can make essentially any physical product at almost no cost. So this will lead to a radical increase in prosperity around the world. And we've seen that as nations

become more prosperous, they lower their population growth. The most advanced countries have negative population growth. Now that will reverse again when we dramatically reduce the death rate. The birth rate will then exceed the death rate once again, and population will grow. But how quickly is it going to grow? It's not going to double every year, it's going to add a few percent every year. So compared to this very slow expansion of the biological population, the wealth creation from nanotechnology is going to expand at explosive rates. We're going to be able to keep up very easily.

WIE: One criticism of the life extension movement has been that these technologies are only going to be available to the rich, and therefore, their pursuit will intensify the class gap between the haves and have-nots—those who can afford to live forever and those who can't. Will we end up with a divided world of immortals and mortals?

KURZWEIL: That's a misconception also. The law of accelerating returns says that there's fifty percent deflation annually in information technology so that you can buy the same digital camera today for half what it cost to buy it a year ago. The typical cycle is that a product starts out unaffordable and actually

potential perils of these new technologies outweigh any potential benefits, no matter how remarkable they might be. Yet you seem to be advocating a no-holds-barred relationship to these developing technologies. Do you feel the risks have been overblown?

KURZWEIL: Technology is a double-edged sword. It empowers both our creative and destructive sides. I had this conversation with Bill Joy in September 1998 and gave him a copy of my book *The Age of Spiritual Machines*, which led him to write the *Wired* cover story "Why the Future Doesn't Need Us" and articulate the downsides of genetics, nanotechnology, and robotics. What was controversial about his article was his call for relinquishment: "Let's keep the good technologies, but there are dangerous ones like nanotechnology and biotechnology—let's just not do those." I pointed out that all technologies are leading, in the end, to those dangerous technologies; that technology is inherently dangerous. And in fact, banning a technology at a broad scale just drives it underground, where it's actually more dangerous, because then the responsible practitioners we're counting on to protect us don't have easy access to the tools. So I think the most dangerous route would be to attempt to relinquish these tech-

Nanobots are going to permeate **OUR**

not working very well—remember when mobile phones barely worked and only the elite could afford them? Then it becomes merely expensive and works better, and then it becomes inexpensive and works very well, and eventually it's almost free and it's really perfected. So it's only at the point where technology doesn't work very well that only the rich can afford it.

Look at the AIDS drugs. They started out costing tens of thousands of dollars per patient and actually didn't work very well. Now, at least in the poorer countries, say, in Africa, it's about a hundred dollars a patient. It's still too much, and yes, we need to do a lot more. But actually, we have the opportunity to save millions of people, because the drugs are only a hundred dollars a person, and they actually work pretty well now. We're not where we need to be, but the technology has moved in the right direction. And that progression is going to accelerate. Ultimately, we'll be able to meet the material needs of the entire population at almost no cost.

WIE: Biotechnology and nanotechnology have both borne the brunt of fierce criticism in recent years. Many feel that the

nologies. If one seriously tried to do that, it would require a totalitarian system. And Bill Joy himself has evolved his position. He's now working as a venture capitalist actually investing in nanotechnology to accelerate renewable energy and other environmentally friendly technologies.

However, there are downsides. We talked about some of the tremendous benefits of genetics and the whole biotechnology revolution in terms of overcoming disease and extending longevity, but it also could empower a bioterrorist with tools found in a routine college biotechnology laboratory to create a biological pathogen that could be quite dangerous. It could be spread easily and be stealthy and deadly.

The answer, though, is not to relinquish these tools. In broad strokes, it is to put more stones on the defensive side of the scale. We're close, for example, to broad tools that could combat biological viruses in general. Now if we can get those quickly enough, we don't have to attack each new virus as it comes along. So what we need to do is identify these risks. We need ethical standards, which have worked very well in the genetic community—at least to prevent inadvertent

problems, to prevent intentional abuse or misuse by terrorists, for example. But the fact that there will be risks is just inherent. I mean, technology is power, and it does empower all of our dispositions, creative and destructive.

WIE: What would you say to the idea that it's unnatural to want immortality? That this quest for life extension goes against the natural cycles of birth and death, and that if we attained immortality, we would have stepped so far outside the natural order that in some sense, we would no longer be human?

KURZWEIL: In my view, we are the species that seeks to go beyond our own boundaries. Fundamentalism is the idea of putting artificial constraints on what humans can be—defining humans in terms of our limitations rather than by our ability to supersede our limitations. We didn't stay on the ground, we didn't stay on the planet, we're not staying within the limitations of our biology, and we're not staying within the limitations of our intelligence. The noblest purpose of human life is the creation, communication, understanding, and appreciation of knowledge in all its forms:

bodies.

from different art forms to different levels of expression in science and technology.

WIE: Some people would say that the meaning of life is, in a sense, defined by our mortality. That our limited life spans push us to spend the time we have wisely, creating a sense of urgency that tends to bring out our best qualities. That such things as courage and heroism, and even creativity, arise from the recognition that "I only have so much time here, and so does everybody else." What would you say to the idea that if we were faced with the opportunity to live forever, we would quickly lose our edge, become lazy, start to take life for granted, and ultimately become more apathetic, self-centered, and indulgent?

KURZWEIL: I think defining meaning in terms of death—saying that death gives life meaning—is to define us in terms of our limitations. In my mind, what's noble is the pursuit of knowledge, and that's going to expand through this exponential

process along the law of accelerating returns. That's really the future of human life.

If you see human beings as no different than peaches on a tree that grow old and fall and die, then that view has merit. But there is something unique, after all, about humans. I mean, it's been said many times that science has thrown humanity off our pedestal of uniqueness and centrality. We discovered that the universe didn't revolve around the earth, that human beings were not anointed directly by God, and that we evolved from worms. And so we've continually had our egocentric view of the importance of humans shattered by these scientific insights. But there actually is one really important way in which humans are unique: We are the only the species that passes knowledge down from generation to generation, where that knowledge base is growing exponentially, and where we go beyond our limitations. Whereas other animals can be seen statically using tools,



they don't create technology that evolves. You know, the combination of our cognitive capability and our opposable appendage, the thumb, enabled us to change our world. And that's what's ennobling, and gives life meaning.

Up until now, we've had no opportunity to circumvent our mortality. So we had no alternative but to rationalize this tragedy—which is what death is—saying, "Oh, it's really a good thing. And it's ennobling; it gives life meaning." A large part of religion is to rationalize this tragic loss of knowledge and skill and personality as something positive. But really, what's positive about human beings is our pursuit of new frontiers.

WIE: It is well known among evolutionary theorists that the chief catalysts for change are stress and challenge. Whether we look at technological innovation, personal transformation, or collective evolution, positive change in any form tends to be driven by external pressures, by challenges that

KURZWEIL: Well, already we can see that that's not the case. We are now pushing evolution forward. Biological evolution is not the cutting edge—it's really our technological evolution. We've taken over the driving force of the evolution of complexity from this evolutionary process that created it. And I think that

I think that the evolutionary process has its own

push us to reach further, dig deeper, create, and innovate. Even this rush for life extension is being driven by the stress of imminent death. In the utopian immortal future you envision, what do you see as the catalyst for continuing evolution, development, and change? In securing for ourselves a trouble-free future in eternity, will we inadvertently be ensuring our own stasis and depriving ourselves of the conditions needed for our own continued development?

the evolutionary process has its own urgency because there are still competitive pressures, and time becomes increasingly valuable when things are moving more and more quickly. We're not motivated only by the realization that we're running out of time because we're going to die in a few years.

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the need to put the next meal on the table. We don't need death to propel that forward. We have a hierarchy of needs: air is pretty much a need, but if you have air, then you worry about food, and if you have that, you worry about shelter. But most

urgency.

of us have already moved on to worrying about ego needs, and beyond that, there are desires to create meaningful knowledge and so on.

WIE: What is your response to the observation that death is part of a process of regeneration, and that it's through the cycle of death and rebirth that the very process you're speaking about happens? That in some sense, evolutionary

progression wouldn't really be possible once the regenerative dimension were taken out of it?

KURZWEIL: Religion talks about transcending death, but it has a mystical answer to how that happens. In fact, we find this transcendence in the real physical world. We find it in technology. If you put materials and energy in the right configurations, magical things happen. You get powers that go beyond the original materials. That's what excites me about being an inventor.

And we will transcend death and that natural cycle. We're not just grapes on the vine—we are overcoming that natural process that we emerged from. Yes, we came from nature, but we are going to surpass it through the power of our technology, which comes from our mind made manifest in the real world. ■

ONLINE EXTRAS: Listen to the audio of Craig Hamilton's interview with Ray Kurzweil on wieunbound.org/kurzweil

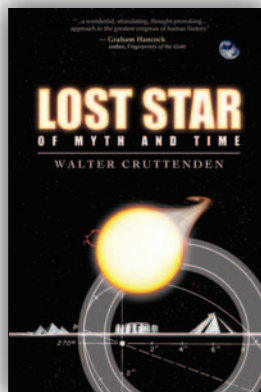
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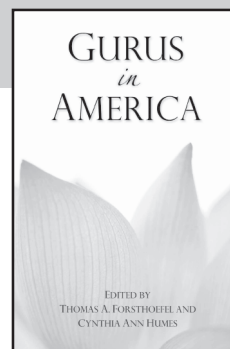
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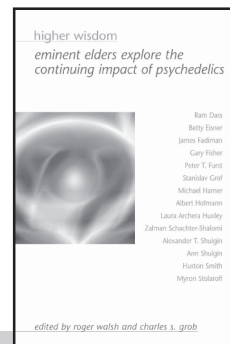
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