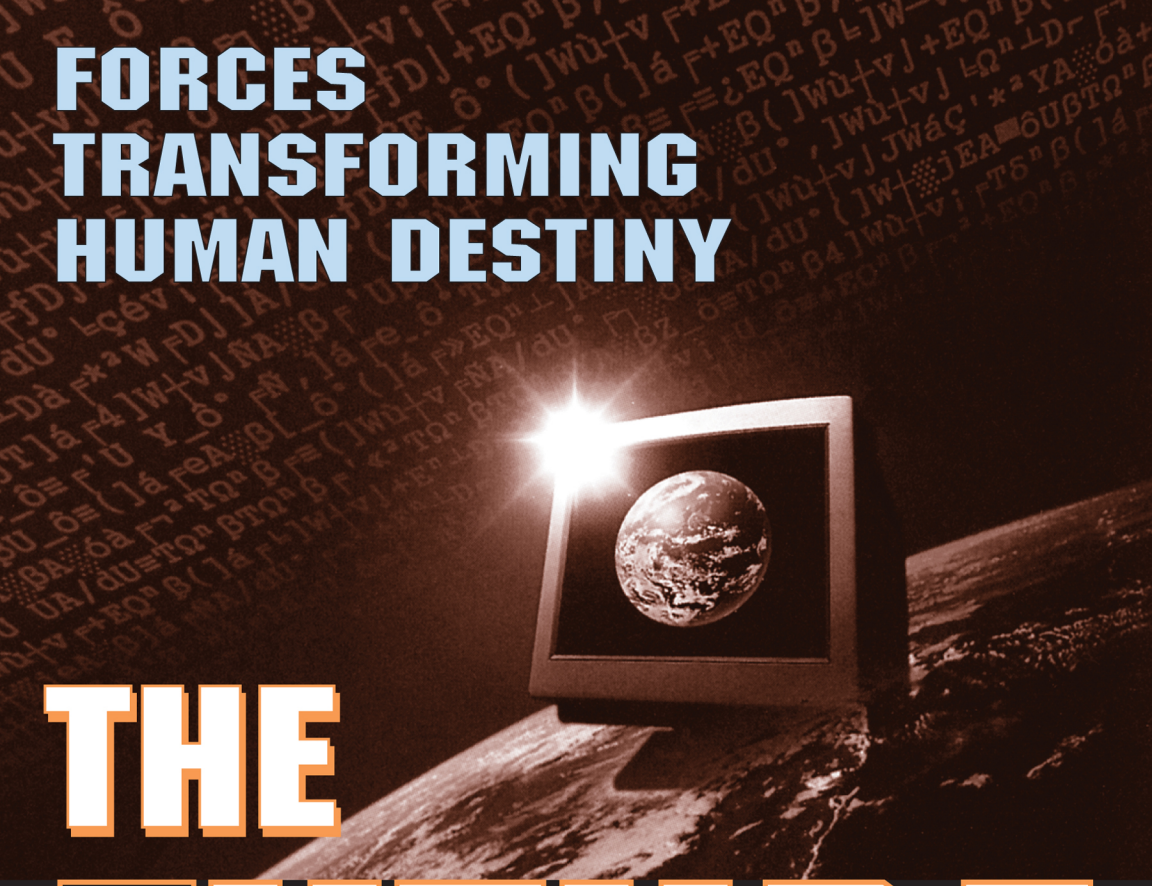
FORCES TRANSFORMING HUMAN DESTINY



THE FUTURE FACTOR

MICHAEL G. ZEY

WITH A NEW INTRODUCTION BY THE AUTHOR

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To George, my father, and Aunt Kay, who brought me wisdom, love, and joy

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Transaction Introduction

Despite its title, *The Future Factor* is as much a book about the present as it is about events to come. The ultimate goal of the book, to be sure, is to create a realistic depiction of future human development. To achieve such a goal, however, I was continually challenged to interpret a broad range of current economic, political, social, and scientific events within the broader framework of my long-term projections about the ultimate fate and destiny of the human species.

In this book I present a very optimistic, upbeat vision of the future of the human species. As I make clear, the human species is already well on its way to creating this pathway to a much better world. During periods of rapid societal progress, such as the late 1990s, it is not difficult to make a case for the interconnection between current affairs and a glorious future. However, during more troubling times, like those of recent years, questions arise about the validity of such rosy prognostications.

Since *The Future Factor* first appeared, our species has certainly experienced a sufficient amount of political and economic turmoil to enable critics to legitimately question any optimistic forecast of the future human condition. The economic slowdown of the first months of the third millennium burst the illusions of millions who expected to daytrade their way to wealth and happiness. Moreover, the upsurge in world terrorism has forced academics and media commentators to redraw their scenarios of a peaceful geopolitical future.

The good news is that even in times of troubling political and economic events, ample evidence continues to accumulate that our species is improving its general material situation and moving in the positive direction originally envisioned in this book. In fact, since the first appearance of *The Future Factor*, several developments and breakthroughs only stand to reinforce my optimism about humankind's future. In this introduction I will review some of the breakthroughs that

are forming the foundation of the next big leap for the human species. Specifically, these include cold fusion energy development, broadband high-speed Internet connections, and what I label the Superlongevity Revolution, innovations that will enable us to produce more goods and services, live longer and healthier, and travel faster and farther.

Certainly, the events that have unfolded since the original publication of *The Future Factor* in 2000 are a cautionary reminder to sociologists and other prognosticators of the inherent serendipity of human events. From late 1996 to early 2000 a global economic boom was in full swing: many countries enjoyed extremely high growth rates in gross domestic product; the U.S. stock market, especially the technology-driven NASDAQ, ran up exponential gains; unemployment plummeted to levels not seen since the 1960s. In a state of near-euphoria learned economists and financial journalists, as well as members of the investing public, convinced themselves that we had finally conquered the business cycle—permanent prosperity had arrived. However, the unexpected occurred. In 2001, and again in 2002, the world economy slowed significantly. The high growth period of the 1990s was followed by a few years of rising unemployment and slower economic growth. The NASDAQ stock bubble burst, and the Dow index receded.

In order to accurately predict the short-term prospects of both the U.S. and the global economy, and to determine the mechanisms by which the next economic recovery will actualize, we should first look at the factors that created the boom and the forces that led to its demise. The dynamics underlying the boom of the 1990s and the post-2000 slowdown are hardly a mystery. One primary engine of the late nineties' economic boom was the information revolution. This spike in technological innovation served as an economic catalyst in a number of different ways. First, the growing ability of high-speed computers and the communications infrastructure as a whole to transmit information helped the economy immensely. This technological leap liberated the financial markets, enabling investors to instantaneously transfer capital to projects and companies anywhere on the globe. Moreover, these high-speed computers increased organizational productivity by accelerating the speed at which suppliers, customers, and manufacturers could communicate. Second, the creation and implementation of

the information infrastructure became a boom industry in itself. Suddenly, organizations of all types needed armies of systems analysts, computer programmers, inventors, software development specialists, and website developers. Manufacturers of computers, fiber optic cable, memory chips, and other core components of the information revolution experienced a boom that sent the NASDAQ stock index into the financial stratosphere.

The information revolution was hitting its stride just as many of the Asian countries' economies were expanding. Throughout the 1980s and 1990s Japan, China, Thailand, Malaysia, Hong Kong, and Taiwan were becoming major economic players on the global stage, their GDPs regularly increasing at rates of 6 percent to 10 percent each year. These newly prosperous countries served as both suppliers of new innovations to the American and global consumer and major purchasers of American products. As a result, world trade soared.

Facilitating this incredible global economic expansion was a gradual stabilization of energy prices. Except for a brief period during the Iraq conflict of 1990-1991, between 1982 and 1999 the price of oil measured in real dollars either remained static or actually shrank. Affordable energy lowered the cost of doing business across the globe, and also reduced the price of many goods and basic commodities. For most countries, inflation, the bane of the 1970s, no longer hampered the production or consumption of goods.

It is important to note that even during these high-growth years, periodically global economic turbulence would manifest itself. In 1997 a currency crisis erupted in the Far East, threatening the entire region's heretofore unfettered economic progress. In early 1998 post-Soviet Russia teetered on the brink of fiscal insolvency and had to be bailed out by a massive infusion of capital from Western banks. In 1999 OPEC's gradual reduction of oil production led to rising energy prices worldwide. Normally events such as these can slow economic growth or lead to a recession. Yet they seemingly had scant impact on this particularly robust economic expansion.

However, even the strongest of economic booms cannot be sustained indefinitely. By mid to late 2000 a confluence of factors slowed down this unprecedented boom. Actions by the Federal Reserve played a major role here. As the GDP expanded at the rate of nearly 6-7

percent per annum, the powers that be in the Federal Reserve became increasingly nervous about the possibility that the economy was "overheating." Fed chairman Alan Greenspan admitted in one of his periodic sermons to the congressional budget committees that he was often mystified by the dynamics of this so-called "New Economy." He even publicly speculated that the root cause of the stock market run-up of the period was not so much unprecedented economic growth, but the unbridled stock-purchasing habits of investors' guided primarily by their "irrational exuberance." Greenspan acted on his fears by having the Fed incrementally increase the prime interest rates by several points over a period of months. Predictably, as the cost of starting new ventures and financing existing projects became more expensive throughout 2000, economic growth began to slow. The timing of the Fed's actions could not have been worse. At the same time industry had to contend with a contracting credit market, it also was facing higher energy prices caused by the aforementioned OPEC cutbacks in oil production.

The Clinton administration also contributed to slowing the nineties' economic boom. The Justice Department seemed determined to bring a variety of anti-trust actions against Microsoft, the company that had nearly single-handedly created the information revolution. Convinced that Microsoft's dominance in the computer software industry constituted a monopoly, the White House announced that it would seek to break up the software giant into three separate companies. Perhaps not so coincidentally, as this case was gathering steam in the courts the NASDAQ index began its precipitous decline from the 5000-point level to about one third its total market wealth several months later. By attacking Microsoft, the Justice Department was sending a signal to every entrepreneurial "New Economy" company: become too successful and you will feel the wrath of the imperial government.

Another factor that further exacerbated the world's economic woes was the protracted U.S. presidential election of 2000. As candidates Gore and Bush fought out the contested election results in the courts, the stock market indexes sank. Between Election Day 2000 and mid-December of that year, when George Bush was finally declared president, the U.S. stock market lost well over a trillion dollars in value, proving once again that the markets hate uncertainty.

By early 2001, a recession had begun in earnest. Then, later that year, the already shaky world economy was sent reeling when Al-Quaeda terrorists attacked the World Trade Center in New York City and the Pentagon. Much has been said about the dramatic political, cultural, and social impact of these tragic events. Suffice it to say that the attacks on September 11 changed the course of history, at least in the short term. The impact of these terrorist incidents on the global economy was even more immediate. Airlines, faced with a massive reduction of air travelers, began furloughing or out-and-out firing thousands of employees, as did the financial community, the information technology sector, and the telecommunications industry. The recently recovering stock market went into a tailspin.

In retrospect, the economic slowdown was surprisingly short-lived and hardly as severe as critics contended. By late 2003 and into early 2004 it became clear that the U.S. and global economies were turning around. Importantly, as we will see a bit later on, several technological breakthroughs are coming on line that will serve to extend this recovery and lay the groundwork for the next economic boom.

GDP levels in the United States in 2003 were already exceeding the 3-3.5 percent level, consumer spending was booming (especially for car and homes), inflation was tamed, and manufacturing activity accelerated. In 2003 the NYSE index climbed almost 20 percent. Technology stocks, the most battered sector of the market, made a remarkable recovery. The airlines were even rehiring employees they laid off during the post-9/11 period.

During the early parts of this economic rebound complaints arose that this was at best a "jobless recovery." By 2002 U.S. unemployment had reached 6 percent while EU countries experienced jobless rates as high as 10 percent. Worsening the employment situation was the fact that U.S. companies in search of cheaper labor exported jobs to foreign countries. Others doubted the sustainability of this nascent economic rebound, pointing to the cost of the war on terrorism, the growing Federal budget deficit, and the relatively slow recovery in Europe and Japan.

Nevertheless, by the beginning of 2004 even the most skeptical of observers had to admit that the economy was recovering. The United States experienced the highest quarterly increase in GDP in twenty years, a 8.2 percent upsurge. In a two-month period in late 2003

American industry created over a quarter million jobs. The *Wall Street Journal* (WSJ) noted that shipping companies such as United Parcel, Burlington Northern Santa Fe Corporation, and trucking giant Yellow Corporation were adding workers and buying transportation equipment at a feverish pace. They were doing so because world trade activity was intensifying.[1] Countries like Korea and China seem to be following the U.S. lead in achieving high growth rates. In fact, according to the WSJ, China's economy is growing at such a feverish pace that the country's industrial demand for copper, cotton, iron ore, and timber is severely taxing world reserves of these commodities.[2] China's growing thirst for oil may also strain petroleum supplies over the next decade.[3]

This current economic spurt is encouraging, and is certainly welcomed. However, as I have stated in earlier books such as *Seizing the Future*, continued robust economic growth ultimately depends on the development and implementation of new technologies. Breakthroughs in information technologies and computer science were a principal reason the world economy grew so quickly in the late 1990s. What technologies, then, must we nurture and develop in order to insure continued economic prosperity over the coming decades?

Certainly, one of the prime energizers of the global economy will be broadband communication technology, the next stage in the evolution of the communications/information industry. Broadband, or high-speed Internet, enables information to flow at speeds hundreds of times faster than the "dial-up" communications technology. Companies such as Samsung, Ericsson, Nokia, and NTT Docomo are feverishly preparing the way for this next information revolution.

Clearly, broadband technologies will play a major role in a strong growing economy of the future. According to a recent Brookings Institution study, universal broadband access could add $300 billion a year to the U.S. economy alone. Scott Cleland of the Precursor Group, a telecom research firm in Washington, stated that "Broadband is clearly an economic multiplier, because it enables applications and uses that aren't feasible with dial-up." Broadband, by accelerating and enhancing the linkages between businesses, suppliers, job seekers, labor, and companies, will increase industrial productivity exponentially. More importantly, broadband promises to invent whole new industries. For instance, such high-speed Internet connections will empower both

home and business users to be not only consumers of media, but media producers also. It is predicted that broadband will allow amateurs to produce and transmit music videos, animations, and audio scrapbooks.[4]

At the end of 2003 only a minority of U.S. households had high-speed Internet access. By 2008, according to the Boston-based Yankee group, half of all U.S. residences will have a broadband hookup. However, at present the penetration of broadband in the United States lags well beyond a host of other countries. South Korea leads the world in numbers of high-speed Internet connections per capita, with 21.3 broadband subscribers per 100 inhabitants. Hong Kong was second, with a per-capita rate of 14.9, and Canada third, with 11.2. The United States ranked a distant eleventh, with a per-capita rate of just 6.9. Economists generally agree that forgoing a major broadband rollout in the United States could hinder economic growth. One of the factors impeding the widespread penetration of broadband is the sheer diversity of delivery modes. Cable companies, telephone conglomerates, and even electrical utilities are competing to become the provider of choice for broadband communications. Additionally, the regulatory morass that encumbers so much of the U.S. information economy is currently slowing the growth of high-speed Internet in America.[5]

Further good news for the economy is the fact that the global space program, a key driver of the tremendous expansion of the U.S. and global economy over the last several decades, is thriving. Moreover, our current achievements in space development indicate that space will continue to play an even more dynamic role in future.

Since its inception, space technology has spurred the globalization of the economy. Certainly, the modern global economy could not function without the hundreds of satellites encircling the earth. These satellites carry the signals that make viable our global communications matrix, including cell phones, wi-fi, the Internet, satellite radio and television, and other communications technologies. This satellite-based global communications network has boosted international trade several-fold, facilitated the creation of multinational corporations producing goods and services unimaginable only a few decades ago, and enhanced the ability of banks and venture capitalists to instantaneously dispatch capital to projects and organizations anywhere in the world.

In addition, the space program's many technological spin-offs have helped create new products and whole new industries. Our scientific work on the space program has contributed to the development of innovations such as CAT scans, cordless tools, the MRI, water filters, smoke detectors, sunglasses that block out ultraviolet light, as well as the laser used in heart bypass and angioplasty surgery.[6]

As this book makes clear, coming ventures in space will enable us to exponentially expand our energy supply, provide us the technology to travel at lightning speeds on earth, and allow us to tap into an untold wealth of raw materials and precious metals awaiting us in space. (Chapter 5 explains how our exploration and colonization of space also enable humankind to achieve *vitalization*, a key component of humankind's destiny.)

At one time, the United States, Russia, and the European Union dominated the global space effort. Now, India, Brazil, and a number of other countries are stepping up their efforts to become major players in space development.[7] Over the last few years, China is making particularly notable advances in this field.

Throughout 2002 China had been dropping hints that it was going to send a man into space. While many observers were impressed at the ease with which China had successfully launched the first four unmanned rockets in its Shenzhou ("sacred vessel" in Chinese) series, they were skeptical that China would make good on its claim that the Shenzhou V launch would carry a human being into space. China refers to this astronaut as a "taikonaut," after the Mandarin word for space. A successful mission would make China the third country—after the Soviet Union and the United States—to launch a manned spacecraft. China's Communist leaders have invested enormous national prestige in the program, which has close ties to the secretive People's Liberation Army.

In October of 2003 China stunned the world by making good on its promise. Three taikonauts were launched into space on China's Shenzou-V.[8] What made the accomplishment particularly ironic was the fact that America had officially placed on hold its manned space program—the explosion of the Challenger shuttle in February 2003 forced NASA to suspend all manned space flight for several months while an investigation of the disaster ensued. NASA set 2004 as the target date for reviving the shuttle program.

Any country that possesses a vibrant space program will have a competitive edge both economically and military. The entrance of China into this field might finally inspire the United States as well as other countries to increase their commitment to space exploration and colonization. Currently the United States is allotting a little over 1 percent of its Federal budget to the space mission, far less than the share of U.S. annual budgets the American people were willing to spend to put a man on the moon in the 1960s. In real terms NASA's budget is 40 percent smaller than it was just a decade ago, when adjusted for inflation.

If America needs any inspiration for rapidly expanding the size and scope of its space mission, she need only examine the very probable goals of China's manned space program. The Communist Party newspaper *People's Daily* said that the flight would enable China to "repair and assemble military satellites that could monitor and direct and control military forces on Earth." China also looks to such flights as a mechanism to develop orbital assets to direct guided ballistic or cruise missiles against targets such as enemy ground and naval forces. It is clear China looks to its space program as a way to counter U.S. military power. On the horizon are a permanent space station, missions to the moon, and eventually a permanent moon base.[9]

Clearly, America will have to commit greater resources if it hopes to harvest the economic, political, and military benefits that a robust space program can bring. In December 2003, President George Bush took a major step in that direction when he announced bold plans to send Americans back to the moon, to possibly establish a permanent moon base.[10]

Nothing is more integral to future economic growth than the availability of a cheap and abundant source of energy. For at least the last century, the primary energy sources have been fossil fuels, especially petroleum. However, the world's future economic growth depends on our eventually finding a substitute for petroleum. Most geologists agree that the supply of all fossil fuels, including petroleum, is extremely limited, certainly not abundant enough to support a rapidly expanding world economy. In addition, persistent turmoil in the Mideast reminds us that at any time our oil supply can be abruptly interrupted.

Over the last few years there have been indications that new technologies will be introduced that will enable us to transition from a

petroleum-based energy system. One particularly promising sign has been the introduction of "hybrid" automobiles such as the Toyota *Prius* and the Honda *Insight* that combine standard petroleum fuel and battery power. While such hybrids still use petroleum as a basic fuel, they do so much more efficiently. The *Prius,* for instance, achieves a gas efficiency of 46 mpg, and some future models might get 70 miles to the gallon. More encouraging was Fiat's announcement in late 2003 that it was making significant progress engineering a car that will run exclusively on hydrogen.[11] In 2002 President Bush had given his blessing to this innovation when he announced that the United States should adopt the goal of transitioning to a "hydrogen-based economy."

However, we need to find a substitute for petroleum that will not just power our car engines, but will also underwrite economic and macroindustrial development throughout the twenty-first century and beyond. Such a source is fusion power, the energy source of the sun and other stars that advocates say would be cheap, abundant, and environmentally friendly. Fusion power, which I discuss at length in chapter 1, is the energy produced when light atoms are fused together to form heavier atoms.

In February 2003 the United States and China proclaimed that each would join the International Fusion Project, whose goal is to construct over the next ten years *Iter*, the International Thermonuclear Energy Reactor. *Iter* is estimated to cost about 5 billion dollars, and bridge the gap between current fusion reactors and the first-ever commercial plant that could follow. *Iter* could begin construction in 2006 and be operational in 2014. Fusion research would last for up to twenty years. The 5 billion dollar construction cost for *Iter* is a drop in the bucket compared to the estimated trillion-plus dollars the United States has spent on Mideast military operations to maintain the steady flow of oil from oil-producing countries and the industrialized world.[12]

China and the United States will enter into a collaborative research effort with Canada, the European Union, Japan, and the Russian Federation in the fusion power project. The Clinton administration had placed on hold American participation in *Iter* while it reviewed and evaluated U.S. fusion policy, but in 2003 fusion power proponent U.S. Secretary of Energy Spencer Abraham prodded the Bush administration to join the project. China is signing on for purely pragmatic reasons—energy experts estimate that China, with its billion plus

population, has by far the largest needs for development of electrical power in the world.

Although public attention, and most worldwide government funding, have been directed to the "hot fusion," large-scale approach to fusion power development engendered in such projects as *Iter*, a quiet revolution has been taking place in the small-scale approach to fusion energy development. A WSJ article in August 2003 entitled "Cold Fusion Isn't Dead, It's Just Withering from Scientific Neglect" brought up a fact that has escaped media and public attention: cold fusion, long considered by the scientific establishment a "failed" and largely discredited technology, is in the midst of a tremendous resurgence across the globe.

From its inception, cold fusion research has been a source of controversy. On March 23, 1989, Stanley Pons and Martin Fleischmann, of the University of Utah, announced that they had achieved a form of fusion energy by using a mere tabletop setup. They claimed that they had induced deuterium nuclei to fuse inside metal electrodes. Furthermore, this fusion, Pons and Fleischmann said, produced measurable quantities of heat. Most shocking was the Utah duo's announcement that they had managed the feat at room temperature. Supposedly nuclear fusion can only occur at temperatures produced by the sun or a hydrogen bomb explosion. The *Iter* project, a "hot fusion" enterprise, will try to achieve fusion reactions at temperatures at levels of millions of degrees Fahrenheit.

Not surprisingly, their claims were met with skepticism. Then, their findings were supposedly "disproved" by U.S. Department of Energy investigators who concluded, after unsuccessful attempts to replicate the Utah University experiments in November 1989, that the Pons/Fleischmann experiments were invalid. "Cold fusion" did not, and in fact, could not, exist, their report said. This DOE report doomed the field, cutting it off from research funding and undermining its legitimacy.

Cold fusion, when perfected, could solve the world's energy problems forever. (Seawater alone contains enough deuterium, the basic material used in cold fusion experiments, to provide electricity for millennia). Encouraged by the sheer potential of small-scale fusion devices, scientists around the world have been continuing the research initiated by Pons and Fleischman. They are doing so in the face of

establishment sentiment marshaled against cold fusion—many physicists are frightened from pursuing this research out of fear of the impact it might have on their careers. More disconcerting is the fact that communication between establishment physicists and those working in this exciting new field has broken down completely. According to the WSJ article, no major physics journal has published a paper on cold fusion in years.[13]

Conference organizers of the 10th International Conference on Cold Fusion held in late 2003 in Cambridge, Massachusetts invited some of the original critics of cold fusion to attend the meeting. Predictably, none showed. At the conference, scientists presented numerous papers describing their cold fusion experiments in which excess heat was successfully produced. Much of the research demonstrating the feasibility of cold fusion is being carried out at major research centers such as the Naval Research Laboratory and SRI International, Menlo Park, California. Physicist Steven Jones of Brigham Young University, Provo, Utah has stated that, "...what we are seeing is very difficult to explain outside of cold fusion. The repeatability of these experiments now approaches 80 percent." More strikingly, Jones says that the fact that we are detecting the signs of nuclear fusion "make us conclude that we are seeing new physics."

The WSJ expressed concern that these striking breakthroughs in a science that might help us achieve energy independence are being systematically ignored by establishment scientists. According to the WSJ article, "Cold fusion today is a prime example of pathological science." However, that pathology is located not among cold fusion practitioners and proponents, but within the scientific establishment itself. "The real pathology," the WSJ says, "is the breakdown of the normal channels of scientific communication, with no scientists outside the tight-knit cold-fusion tribe bothering to scrutinize its claims."

Establishment scientists are simply ignoring the wealth of evidence emerging from laboratories worldwide that heat is being produced from these interactions. The WSJ writer laments the absence at the conference of physicists who could critique and evaluate the results of these experiments. MIT professor Peter Hagelstein, an award-winning DOE physicist now ostracized for his work on cold fusion, is similarly dismayed. According to Hagelstein, critics of this nascent technology "still won't read the papers" that demonstrate the efficacy of cold

fusion. One would think that the establishment's curiosity would be peaked by a 2002 paper published in a Japanese physics journal describing the transmutation of elements through cold fusion. Hagelstein aptly describes cold fusion critics' strange application of the scientific method when dealing with cold fusion: "If you 'know' that cold fusion is impossible, then you don't have to pay attention to these results."[14]

Cold fusion could be a world-saving technology, operating at a level of physics few understand. So why is the scientific establishment stonewalling, refusing to even acknowledge the existence of these experiments and in some cases the field of cold fusion itself? A little-known 2001 documentary delving into this very question, *Cold Fusion: Fire from Water*, claimed that politics, economics, and career ambitions, not some mysterious "pathology," are preventing cold fusion from becoming an accepted science and technology. The documentary chronicles the international professional feud between the proponents of hot and cold fusion. The programs' producers purport that hot fusion researchers worry that the millions of dollars in government grants they receive for their own hot fusion projects would be endangered if it becomes accepted fact that cold fusion can be achieved as easily and cheaply as the cold fusion crowd claims. Hence, the documentary says, the hot fusioners conspire to insure that cold fusion research is systematically ignored and their research short-funded.

This documentary also revealed that cold fusion is rapidly transcending the experimentation stage. It presented example after example of companies such as New Jersey's Blacklight Power and Thermacore, Inc. that are already planning to commercially apply these cold-fusion style breakthroughs to various industrial uses. Florida-based Clean Energy Technologies' Paterson Power Cell is producing prodigious amounts of excess heat using cold-fusion technology. It would seem only a matter of time before such commercial applications, when successfully adopted by the public and industry, will overwhelm the current opposition to cold fusion science. We just might be on the verge of an energy revolution of historic proportions that few foresaw only a few years ago.[15]

Another bedrock of future economic growth is the rapid extension of the human lifespan, an ongoing development I refer to as the Superlongevity Revolution.

Since the original publication of this book, the creation of new technologies to make true life extension a reality has accelerated. In only a few short years, science has made revolutionary breakthroughs in a variety of life science technologies, including genetic engineering, cloning, tissue regeneration techniques, stem cell research, and nanotechnology. Such technologies promise to enable our species to create human beings that are smarter, stronger, and capable of longer life. Science is challenging the basic rules governing nature itself, and seems to be literally reworking human biological evolution.

Such breakthroughs have raised hopes that we will soon expand the human lifespan to the 125-150 year range. Average life expectancy in the United States has increased from forty-seven years to close to eighty in just about one century. Japanese women can now expect to live past eighty years of age.[16] And recently some Japanese women have lived almost to 120.[17] All of these radical extensions of the human lifespan occurred without the application of a veritable battery of promising new medical technologies about to be introduced.

Of all the recent breakthroughs, genetic engineering and gene therapy might have the most immediate impact on human life expectancy. By 2001 the Human Genome Project researchers had mapped out the genetic structure of the human body, at least ten years ahead of schedule. Such progress accelerated the timetable for uncovering the link between particular genes and diseases such as Alzheimer's, Parkinson's, macular degeneration, and many other maladies. Before long we will perfect the genetic engineering techniques to disarm and neutralize such diseases by placing beneficial genes into the cells of patients suffering from these illnesses.

Through gene therapy, says Salk Institute professor Inder Verma, we can either eliminate the defect, neutralize the defect, or in some way interfere with or slow down the progression of the disease. We can only imagine how the elimination of such diseases will radically extend the human lifespan.[18]

Doctors using such techniques have already had considerable success combating pernicious maladies such as the "Bubble-boy Syndrome" and Cystic Fibrosis. In 2002 researchers in Italy and Israel announced that they used genetic engineering techniques to cure two children afflicted with the so-called "Bubble-boy" disorder, an inherited immune system disorder that forces sufferers to live in a tightly-

sealed "bubble" or face death from exposure to ordinary microbes. The scientists injected the children with bone marrow stem cells that were altered to contain the enzyme gene missing in their genetic makeup. According to Dr. W. French Anderson, a University of Southern California genetics pioneer, "It proves our basic premise that if you can get enough gene-engineered cells into the patient it will cure the disease." Researchers are also claiming some success in using gene therapy to alleviate cystic fibrosis in many patients.[19]

The Geron Corporation's efforts to locate and harness what they label the "immortality gene" that regulates the entire aging process create the possibility that we might also genetically engineer the human body so that it does not age. By manipulating the gene, researchers would be able to literally stop an individual's aging process in its tracks so that the treated person's cells will not age or die. Once we can control this gene, most people, tempted by the prospect of staying physically young indefinitely, by age twenty or twenty-five will routinely begin whatever treatments are necessary to flatten their aging curve. Other researchers are looking for the genetic roots of aging. At a Southern Illinois University lab, the so-called Methuselah Mouse, which had been genetically engineered not to respond to a growth hormone, died in 2003 at the equivalent of 180 to 200 human years.[20]

Stem cell technology, when perfected, could extend human life, perhaps indefinitely. Stem cells are the body's basic engines of growth, the agency that transforms a single fertilized egg into a human. Embryo stem cells are undifferentiated cells that develop into skin, blood, bone, nerves, and eye tissue. Scientists plan to use such stem cells to grow new muscle in a patient with a damaged heart, restore a failing liver, or repair damaged nerves in spinal injury patients. In 2002 U.S. doctors used embryonic mouse stem cells to treat Parkinson's disease in a rat.[21] In 2003 Australian doctors edged closer to perfecting a technique by which stem cells could repair damaged brain cells of multiple sclerosis sufferers. In June of that year surgeons with Ohio Heart Health Center, during coronary artery bypass surgery on a heart failure patient, injected a patient's own muscular stem cells into his damaged heart muscle in an attempt to re-grow new functional heart muscle.[22]

Geron, by the way, is just one of the many companies comprising what I label the "Immortality Industry," where scientific genius and

visionary venture capitalism converge to create life-extending and life-enhancing products and technologies that are making the Superlongevity Revolution a reality. Pharmaceutical corporations, as well as companies and individual practitioners researching the aging process, populate the Immortality Industry, working on the frontiers of medical science in such fields as cloning, cryogenics, tissue research, genetic engineering, bionics, and stem cell applications.[23]

This multibillion-dollar industry will become one of the primary engines of growth of the twenty-first century global economy. The Immortality Industry includes maverick scientist-entrepreneurs such as Craig Venter, who decoded the human genome and whom the U.S. government has just commissioned to create whole new life forms in the test tube; Advanced Cell Technology, a leading pioneer in cell repair and regeneration; Genentech, whose scientists design medicines to fix known molecular flaws underlying diseases like macular degeneration, as well as colon, pancreatic, and breast cancer; and Infogen, a company involved in accelerating advances in human cloning. Alcor and other companies have been trying to promote freezing as a way to live after death and, in a certain sense, to travel to the future. (A full-body freezing costs $120,000, but Alcor runs a special—they charge only $50,000 to those wanting to freeze just their head.) The new corporation Cell Factors plans to supply tissue-specific "neural-derived cell-lines" for a diverse range of pharmaceutical life-extension applications. Pennsylvania-based Pharmastem Therapeutics, Inc. is pioneering the use of stem cells as an alternative to bone marrow transplants.[24] Included here are companies such as Pfizer, producing the "sexual-regeneration" drug Viagra. This category also encompasses companies producing and delivering products such as Botox, the controversial wrinkle-smoothing injection, and various growth-hormone drugs, including GBH. In October 2002 the first ever Anti-Aging Drug Discovery & Development Summit was held in San Francisco, California. Many of the companies at the forefront of the burgeoning immortality industry were represented.[25]

The Immortality Industry is helping to fulfill the public's desire to not only live longer, but to retain a youthful body throughout that long life. People are embracing many technologies to both expand their mental and physical capabilities and enhance their physical appearance. Two of the more ingenious of these devices are the cochlear

implant, which enables the deaf to hear, and the "artificial retina," which promises to bring sight to the blind. We are even now seeing people with adequate sight and hearing, not just the near-blind and deaf, turning to such technologies to imbue them with "super" vision and hearing. Other examples of this phenomenon abound.[26] People are already using superhormones such as GBH to induce body growth, stave off disease, and replenish hormones that their bodies are no longer producing.

The Superlongevity Revolution will reach its ultimate fulfillment with the perfection of nanotechnology. Nanotechnology is an exotic new science based on the theory that any material or object can be constructed from the "bottom up," one atom at a time. When perfected, nanotechnology will not only extend human life expectancy but will offer the possibility of the human species achieving "near-immortality." Nanotechnology will enable us to reconstruct damaged organs—limbs, eyes, and bones—quite effortlessly. Someday "nanobots" will cruise through our bloodstream, seeking out and repairing damaged blood cells and genes and banishing harmful viruses. We will be able to construct diamonoid, a substance that we could use to weave a layer under a person's skin that would serve as a veritable permanent invisible bulletproof vest. With nanotechnology we could design wholly new organs that would enable us to adapt to any environment, including those of other planets.

It has already been demonstrated that nanotechnology can be used to enhance the power of the brain. In August of 2003, a molecular biologist and a nanoscientist at the University of Central Florida announced that they discovered a way to use nanomaterials developed for industry to triple or quadruple the life of brain cells. Brain cells in rats that were so treated with these materials began to function as "young" cells.[27] The possibilities of such a reengineering of the brain at the molecular level are boundless. Scientists claim that this breakthrough will allow us to possibly reverse the ravages of Alzheimer's disease by introducing these rejuvenating nanomaterials into the brains of patients suffering with such an affliction. Perhaps in the future people wishing to ratchet up their intelligence and perceptive abilities will routinely undergo procedures in which nanomaterials are applied to sections of the brain that require physical rejuvenation. These breakthroughs only reinforce the currently popular view that the brain

possesses a quality known as neuroplasticity, the ability to rewire and revitalize itself (or in this case, to be rewired by an external agent.)[28]

Recent experiments have shown that by radically reducing the caloric intake of certain animals we dramatically increase their lifespans. At the National Institutes of Health, rhesus monkeys fed 30 percent less than their normal food intake live to incredible ages, while avoiding age-linked maladies. One monkey on such a diet has lived to thirty-eight years, the human equivalent of 114 years. Studies show calorie restriction leads to increased lifespan in a wide variety of animals, including rats, guppies, water fleas, yeast, spiders, and a microscopic water invertebrate called the rotifer.[29]

New life extension techniques such as stem cell technology and nanotechnology promise to increase the human lifespan potential to 125-150 by the year 2050, and soon thereafter literally obliterate known boundaries of the human lifespan.

Cold fusion, broadband, biomedical science, and the space program will be among several technologies that will accelerate economic growth. More importantly, they are part of the arsenal of new technologies that will enable the human species to fulfill the destiny I describe in chapter 6.

Let me conclude this introduction to the new edition of *The Future Factor* with some observations about recent empirical findings and theoretic advancements related to the concept of human destiny advanced in this book, the Expansionary Theory of Human Development.

There are a plethora of books published that prognosticate about the next decade, the next century, even the entire coming millennium. Rarely, however, do such books attempt to address what would seem the most basic of questions: why is humanity building toward the future that the writer predicts will occur? What forces are driving us to strive so diligently to achieve the future described in the author's imagination? From my viewpoint, constructing a realistic scenario of future human development requires a firm sense of why people do what they do. Suffice it to say that the human species will shape all future actions around such basic drives. Misunderstand that guiding motivation and you have little hope of accurately predicting future behavior.

In *The Future Factor* I attempt to tackle the big questions: Why does man exist? What is the ultimate purpose of the human species? Where is humankind going? Or, as I phrase these issues in my public lectures and speeches: Why us? Why here? Why now?

In a nutshell, the Expansionary Theory of Human Development posits that the human species is a unique entity that can and will play a special role in the greater cosmological framework. According to this theory, over the eons, humankind will apply its ingenuity to overcoming the forces of entropy. The theory synthesizes ideas from astronomy, cosmology, anthropology, physics, sociology, and other fields, and borrows from Kaku, Dyson, Darwin, Teilhard de Chardin, Gribbins, Rees, Moravec, Kurzweil, the Russian Cosmism school, and others. This theoretic synthesis incorporates ideas such as the Anthropic Principle, complexity theory, and the Big Bang theory, and reflects recent discoveries in physics, astronomy, and astrobiology.

A key focus of *The Future Factor* is establishing how our current and future innovations in biotechnology, aerospace, and computers will hasten humankind's achievement of its destiny.

Let me make clear that the Expansionary Theory was, and is, a work in progress. I am currently reworking part of the theory to incorporate a vast number of theoretic breakthroughs and empirical discoveries that are advancing this exciting new vision of man's ultimate purpose. The Hubble spacecraft is daily transmitting data that expanding our knowledge about the origins, and the future, of the universe. We are making new discoveries about how comets and "cosmic dust" have contributed to the formation of life on Earth.[30] The Anthropic Principle, the idea that our universe possesses properties unique to the formulation of life and the human species, is gaining new respect and general acceptance among physicists, cosmologists, and other members of the scientific community.[31] In addition, a novel interpretation of Darwinian evolution is being promulgated by the Budapest-based General Evolution Research Group and especially GERG member David Loye.[32] This new Darwinism emphasizes the role of cooperation, not competition, as the primary strategy in advancement of species. Such an interpretation supports a major premise underlying the Expansionary concept—that the human species was, and is, an active and conscious player in the evolutionary process.

Since the original publication of *The Future Factor*, I established a web presence for my organization, the Expansionary Institute, at www.zey.com. Now, members of the public, professionals, and the media can obtain current information about new scientific discoveries and technological breakthroughs in a wide variety of fields. The website also describes the many political, cultural, and sociological events and developments facilitating, and in some cases hindering, the implementations of these innovations. Increasingly the Institute is focusing its research energies on the study of the impact of "superlongevity," the radically extended lifespan, on society and the economy. Other research projects focus on communications innovations, new energy sources, and high-speed rail. The website content reflects these new emphases.

Over the last several years I have been fortunate to have the opportunity to communicate my ideas about the future, and specifically about the expansionary perspective on the future, through numerous media appearances, public lectures, and newspaper and magazine interviews. Such events and appearances enable me to judge public response to the optimistic vision contained in this book and in my previous work, *Seizing the Future*. I can safely report that by and large the public embraces a future in which they will live longer, healthier lives, colonize space, travel on trains going 300 mph, and enjoy the other benefits described in this book. In fact, once they learn about the infinite possibilities awaiting them, they demand to know when such marvels will become available to them.

I was particularly amazed at the positive reactions to the concept of "superlongevity," the radical extension of the human lifespan. Just the mention of the possibility of "near immortality" in a mid-2003 Reuters interview quickly drew the attention of newspapers all over the world, and led to appearances on diverse media venues such as Brazilian television and Italian weekly magazines. America Online even featured this story on their "welcome window" seen by millions of web viewers. I came away from this experience convinced more than ever that people will enthusiastically embrace a pro-growth, pro-longevity world.

Such enthusiastic response also reminded me that in times like these, the optimistic vision contained in *The Future Factor* is needed more than ever.

Michael G. Zey
Morristown, New Jersey
March 2004

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