Chapter 10
Progress for the Universe

He not busy being born is busy dying.
Bob Dylan

Where nothing any longer seems either forbidden or permitted, honest or dishonorable, true or false.
Alexis de Tocqueville

One ca'n't believe impossible things. — Alice
Why, sometimes I've believed as many as six impossible things before breakfast. — The White Queen
Through the Looking Glass — Lewis Carroll

Will progress continue and if so what form will it assume? Many of the measures used in earlier chapters to define progress incorporate practical limits. Biology determines human life spans, although science may extend them significantly beyond the Biblical "three score years and ten." Public health, good nutrition and improved medical technology can shrink infant mortality only so far, certainly not below zero. People can enhance their education markedly but given a finite human life and the necessity of spending part of it gainfully employed, men, women and children can devote only so much time to schooling. Other measures of human well-being, such as freedom and equality, may also realize bounds. Since anarchy, the absence of any government, would produce chaos and rule by the strong, not progress, freedom cannot expand beyond a libertarian view in which government exists only to protect one person from another and one nation from another. Human beings possess different abilities and drives; hence equality has certain natural limits. Attempts to force more equality than nature has bred will ultimately erode liberty, another crucial component of progress. Can progress persist after these limits are reached?

Limits on Progress

Knowledge may have no bounds. The universe is a mind-bogglingly, almost (?) infinitely complex structure. Science keeps enhancing our understanding, but every time our hubris convinces us that we have solved the basic scientific riddles, researchers uncover new realms of knowledge of which we were totally unaware. For example, at the end of the nineteenth century, physicists believed that they understood nature and only a few small points needed clarification. This was just prior to Einstein's formulating the

general theory of relativity and the breakthrough of quantum mechanics — the two major revolutionary ideas in physics of the 20th century.

Today many scientists presume the basic rules of the universe are known (Horgan 1992): "All that remains … are puzzles." Steven Weinberg in *Dreams of a Final Theory* sketches out the fundamental principles that nature obeys. As Nobel winner Weinberg avers, we may be on the brink of discovering the final theory that will answer all elemental questions. If physicists construct such a brilliant intellectual triumph, science will focus on filling in the gaps, which may induce a gradual slowing of scientific innovation. As the expansion of knowledge lags, technological advance could approach a limit. Even if the basics of the universe are at hand, however, an infinite number of questions addressed to deciphering the complexities of the world around us will surely remain. The new frontiers may lie in biology and the mind.

Many enigmas in science are perhaps unknowable. Chaos theory warns that a great number of processes are unpredictable. The evolution of life, life itself, and human behavior would all appear to be chaotic. Science itself may be capricious; knowledge may advance forever. Thus the concept of progress should embrace enlarging human understanding of nature and of mankind. Many people, however, may not consider an advance in knowledge significant progress.

Future progress could also take the form of improving human lives in other ways. Until this century, daily work has typically proved hard, repetitious, and boring. People, however, can gain considerable satisfaction from their jobs. An increasing proportion of men and women in the Western world are employed in occupations which accord them esteem and pleasure. Many callings offer attractions above those that are monetary. The professions of artist, performer, doctor, scientist, researcher, teacher (at least in many cases), architect, writer, and journalist are just a few that can contribute meaning to life. The creation of more such jobs, yielding fulfillment, would result in progress. Continued progress will at a minimum provide people with more satisfying lives.

Most men and women gain considerable happiness and satisfaction through their families and friends. Public opinion surveys normally find that personal relations provide genuine meaning to the lives of most individuals. The breakdown of the nuclear family as discussed in chapter 3, therefore, is troubling. On the other hand, single parent families can also furnish the mother or father a major purpose in life. Thus the weakening of the husband-wife parenting relationship does not necessarily imply a decline in satisfaction from the family.

Except for the potential to expand knowledge forever and the possibility of realizing more meaningful lives through additional challenging and interesting jobs, most simple

straightforward measures of progress, such as life expectancy, infant mortality, and education, will not suffice much longer. Economic growth will persist along with the flowering of science and technology. Relying simply on a proliferation of material goods as a measure of progress cannot satisfy many that *Homo Sapiens's* well-being has improved. Beyond some total, increasing consumption appears pointless. As humans reach a maximum life span and totter into an aimless old age, mankind may find itself without purpose and without any hope for further gain. Economist Robert Nelson, writing about the relationship of theology to the market in *Reaching for Heaven on Earth*, for example, questioned the nature of material progress (10):

> Does the process of economic growth actually have no end — supplying ever greater amounts of goods and services to satisfy an insatiable appetite, while still leaving the basic human condition little if at all affected? If so, could this mean that economic development is really a treadmill, like an arms race yielding current winners and losers but no permanent gain for mankind?

The Direction of Progress

Once a certain level of abundance has been reached, people enjoy the time, energy, and interest to pose more fundamental questions than "what's for dinner?" After man had found a cave, filled his belly, and learned to speak, mankind became concerned with why he is here? What is the purpose of human life? Is there a purpose? Is there a plan? Often societies have looked to religion for the answer: God or gods have willed it. Man must satisfy the wishes of God in order to achieve the happy hunting ground, empyrean, paradise, Zion or Heaven.

Many people question religion and dispute the existence of a hereafter; a reliance on satisfying God no longer will work for those who have absorbed the teachings of modern physics. Contemporary cosmology can sketch the origins of the universe, the solar system, the beginnings of life, and the evolution of man without resorting to a spiritual being. According to physics, God could have fashioned the laws of nature, but *all* developments since the Big Bang are the product of those laws, chance, and, in the last 200,000 years, man's behavior.

Twentieth century religion has failed to enunciate an alternative to the doctrine that God created humans to satisfy His will. Mankind presumably is not permitted or is unable to understand the purpose of this willful act. Thus Christian dogma simply asserts that people should have faith that the Almighty has a design in creating human beings but it is not for us to know it. Even though science has reduced God to being at most the greatest physicist ever, public opinion polls reveal that most Americans believe in God, a life-after-death, and Heaven. According to some, God wants man to be happy, complete, and to

explore himself. Others view God's aim more harshly as requiring strict obedience to His dogmas. Apparently most Americans find solace and meaning in a supreme being; faith satisfies the mystery of the purpose of life. To others, who find that science has dethroned man and designated him another life-form no more special than a cockroach, an amoeba, or a poison oak plant, identifying a design for humanity is more troublesome.

As discussed earlier, many people find a meaning to life through their work, their families, and their religion. In the West, a goodly number of the populous live for the enjoyment of life, including the perpetuation of their families. Inertia or fear of death may be all that motivates some humans to continue living, yet sometimes men and women become wrapped up in great causes to which they dedicate their beings. These passions then provide life with meaning and purpose.

The thirst for such crusades motivates dedicated revolutionaries, devout communists, fanatical environmentalists, terrorists, and disciples of extreme religious sects. People often feel more satisfied with life and experience more well-being when working with others towards a *vital* goal. War, revolution, or terrorism in the name of a noble mission can provide this exultation, which explains why these activities persist even in prosperous Western societies. War in particular has been very popular in times past because of the inner satisfaction that working for a common goal — to defeat the enemy — furnishes the participants. Many who fought in World War II, for example, look back on the experience as a highlight of their lives.

Bourgeois society can never provide this inner satisfaction; men and women must find their own cause or purpose in life. Most would consider a country at peace in which men and women spend their days working, consuming, caring for their families, and socializing with friends, neighbors, and colleagues a proper one. Nevertheless, many find it dull or lacking. To quote William Wordsworth "Getting and spending, we lay waste our powers." As Fukuyama asked (1992: 314): "[W]ill citizens …[find]… the life of rational consumption in the end, *boring*?"

Fukuyama's answer to whether man will be content to live by bread alone, whether material prosperity and well-being by themselves will be satisfying, is to counsel people to undertake new challenges. He advises that entrepreneurship and striving for success in sports, arts, science, and risky endeavors such as building a business, doing research, or entering politics can deliver achievement and recognition. In addition, the conquest of space may be arriving at the right time to equip mankind with a major new goal.

Progress of the Universe

As shown in earlier chapters, *Homo Sapiens* has made genuine progress. Until now, this book has been considering progress in purely human terms, but in a very real

sense the universe has been progressing from its earliest origins. From the moment of the Big Bang until the present, the universe has grown more complex. Starting from a theorized single super-symmetric force, the cooling of the universe broke this unifying force into at least four basic forces and into two known subsets of particles: hadrons and leptons. In turn, these combined to form atoms, then molecules and compounds. Ultimately, after 10 billion to 15 billion years, life developed on an obscure planet, in an out-of-the-way part of a normal galaxy. Living beings, perhaps intelligent, may have evolved elsewhere as well, although we have no evidence of it.

On earth the first living cells evolved and — after an amazing series of fortuitous events — spawned human intelligence. Had the earth been more stable and less subject to cataclysmic events, such as the impact of large meteorites, the dinosaurs might still rule the earth. The advent of cold periods and ice ages may have stressed hominoids enough to force the development of intelligence while a more clement climate might have left our ancestors to gather nuts and fruits from tropical plants without ever developing language or upright walking.

Over a relatively short period — about 200,000 years — mankind invented language, writing, technology, science, art, literature, and religion. Human beings went from being animals, subject to the vagaries of nature and the weather, to controlling for the most part their environment. Through much of this period, many, perhaps almost all, humans lived "poor, nasty, brutish and short" lives. The development of agriculture, although necessary to sustain large populations and ultimately to support complex cultures, probably visited misery and slavery on millions worldwide. Prior to the invention of farming, aborigines experienced short life expectancies and high maternal and infant mortality, however their circumstances may have been preferable to that of early cultivators. The hunter-gatherer, ignorant of science and medicine, deprived of literature, confined to simple musical instruments, and dependent on weather fluctuations, the migration of prey species, and the absence of other tribes competing for the same substance, may have enjoyed an elemental pride, a rough egalitarianism, and a contentedness with his or her well-being. Myth and religion substituted for science and medicine. Sagas and tales told around the campfire replaced literature; tribal dances accompanied by simple percussion instruments and perhaps an occasional flute provided musical nourishment. These primeval people may have been as satisfied with their performers as modern audiences are with twentieth century orchestras — most people apparently prefer the music they grew up with to new sound combinations. Occasional hunting, sharing of the fruits therefrom, and a stable, uncomplicated way of life may have been altogether agreeable. Certainly primitive hunter-gatherers who have come in contact

with more advanced civilizations have shown no desire to abandon their tribal customs, although they have typically adopted modern technology quickly. Ultimately, their societies appear to fall apart under the competition from the Western world.

The Inevitability of Progress

Whether the human race would have been better off if people had remained as hunter-gatherers is moot. It was inevitable that mankind would look for ways to guarantee a more abundant and constant source of food than game and gathered fruits, vegetables and nuts could supply. As population pressures grew, the need for a reliable supply became more urgent. Agriculture probably first appeared somewhere in the Middle East, but it was independently invented elsewhere as well. Anthropologists have unearthed considerable evidence that farming spread from the Tigris and Euphrates river valleys into Europe. Both in the New World and in Asia, however, the planting and harvesting of grain crops was common long before explorers from the Middle East or Europe made contact with those regions.

People invented agriculture along with all the other great innovations of mankind — fire, iron, writing, the wheel, domesticated animals, and ultimately the steam engine and electricity — in order to satisfy some need. Men and women possess an insatiable curiosity and ambition to tinker so as to improve their lives. Millions if not billions of people are continually striving to better their circumstances. They are upgrading their homes, easing and speeding their work, facilitating domestic chores, beautifying their surroundings. Most of these changes contribute to progress. Together they move mankind towards a more comfortable, secure, rich, and enjoyable life.

Friedrich Hayek has contended that progress is indispensable and virtually inevitable for Western countries. He expresses it this way (1960: 51):

> The consequence of past progress — namely, world-wide extension of rapid and easy communications of knowledge and ambitions — has largely deprived us of the choice as to whether or not we want to continue rapid progress. The new fact in our present position that forces us to push on is that the accomplishments of our civilization have become the object of desire and envy of all the rest of the world. Regardless of whether from some higher point of view our civilization is really better or not, we must recognize that its material results are demanded by practically all who have come to know them.

The desire for knowledge, the willingness to experiment, and the effort to seek a better life is fundamentally unstoppable. By attempting to center all authority in the state, dictatorships, absolute monarchies and communism constrain individual efforts to improve well-being. A worldwide communist state could, therefore, actually threaten progress.

Fortunately, communism is almost dead as a system and remains only a flickering revolutionary cause in a handful of poor Third World nations and an intellectual exercise at some universities. Even had communism seized power worldwide, the stifling of initiative and the hindrance of progress would not have survived forever, although humanity might have endured a long hiatus before progress began again.

Totalitarian regimes could retarded mankind's advance, but not end it. Absolute monarchies in Asia, the Middle East, and Europe delayed and prevented any real progress in their societies, but given the competition that those states faced from others less autocratic, their absolutism eventually crumbled. A worldwide despotism could conceivably halt progress for centuries, but fortunately such an event appears extremely improbable.

Earlier chapters discussed the tendency in democratic states for the government to expand, dominating more and more economic activity. Not only will this slow improvements in productivity and income but it will diminish freedom. Offsetting this drift towards centralized control is competition among countries. As economic historians, such as Douglas North (1981) and Nathan Rosenberg (1986), have contended, economic growth, freedom and democracy were the unintended products of rivalry between secular and religious authorities and among various Western countries. For the future, we can bank on continued competition among nations. Even today the United States government feels compelled to limit its extension and power over the private sector in order to promote the competitive position of the American economy. Sweden, which has suffered from anemic economic performance in recent decades, is paring its welfare state and permitting more scope for individual initiative.

Although progress is inevitable, many dignitaries, especially clerics in Third World nations, bitterly resist it. These rulers, holy men, and powerful interests understand that new knowledge, economic change, and the modernization of their peoples, threaten their world view and their power. Most Muslim countries, for example, have resisted strongly the ideologies underlying Western civilization. The rise of fundamentalism in the Arab world reflects an abhorrence of the culture and power of the West and an ambition to restore traditional values. The hatred voiced in Iran for the Great Satan, the United States, stems from viewing America as the principal locus of the rational scientific approach to the universe that so threatens their teachings.

As the ferment in the Moslem world signifies, the rejection of the West and rationalism will fail as a strategy. The longer a state persists in resisting modernization and science the further it will fall behind the rest of the world. As its inhabitants recognize their ignorance and relative poverty, pressure will build to adopt pragmatic utilitarianism and

imitate the West. The nineteenth and twentieth centuries have witnessed the continued humiliation of Arab states, the latest example being the debacle inflicted on Iraq by the United States. These nations will remain poor, backward, and despotic until their peoples recognize the futility of clinging to traditional ways. For the sake of their masses and their culture, we can all hope that they will soon interpret the Koran in a way that allows science and research to flourish. No matter how much they resist, the success of science and its resulting technology will eventually force Arabs, Hindus, Sikhs and other cultures to accept the tenets of rationalism.

Primitive societies enjoy even less latitude to preserve their customs, to linger outside the market economy, and to avert modernization. Wherever aborigines have come in contact with the West, they have quickly accepted metal knives, axes, plastic bottles, guns, and eventually radios. As these tribes have become more dependent on the outside world to provide these goods, they have been increasingly drawn into trade and commerce with alien merchants.

Unfortunately for unsophisticated indigenous peoples, contact with the West undermines their society and customs. Trading with foreigners exposes their populace to new, outlandish ideas and practices. Radio and television flaunt the wealth, customs, and mores of the outside world before these tribal households, teetering on the edge of subsistence. As a result, the population becomes demoralized and degraded, leaving them suspended between a known, comforting, traditional way of life or joining an impersonal world which contains none of their customary emotional supports. The poverty and degeneracy exhibited on American Indian reservations, in Eskimo villages, and among other indigenous peoples around the world testify to the unfortunate consequences of the modern world's influence on non-technological societies. It is not a pretty picture, but it seems inescapable. Either these people join the rest of the world, accepting a rational scientific world based on impersonal market relations, or they perish.

Oriental countries seem adapt at embracing a rational pragmatic approach to nature without fearing their cultures will be overwhelmed. In general the Japanese, Chinese, and most South East Asian peoples embrace the concept of a logical universe, which can be understood and manipulated by modern science and technology. As a consequence, most of the nations along the western Pacific rim, especially those that have adopted open markets, are expanding at unprecedented rates. Progress is rapid in these booming market economies.

Only the elimination of humanity can permanently stop progress. As the previous chapter contended, a prolonged, cataclysmic, nuclear war could eradicate mankind, although it is improbable that countries would let war get so out of hand that all of

humanity would be threatened. With the demise of the cold war, this menace now seems remote. The future is, of course, unknown, but nuclear weapons are becoming cheaper and easier to make. The genie is out of the bottle; the knowledge of how to construct weapons of mass destruction is spreading and cannot be contained. Attempts to prevent nuclear proliferation can delay the spread of such weapons by only a very few decades at best. Ultimately petty dictators in relatively poor nations will have access to nuclear bombs. At some time in the next century, they too will possess the ability to launch devastation on places halfway around the world.

Neither nuclear war nor atomic blackmail is inevitable. Technology advances; the history of weapons teaches that after the invention of an offensive weapon, a defense is developed but with a lag. For the next hundred years at least, the West will enjoy a large technological superiority and is likely to devise a shield from such attacks. “Star Wars” may have been premature, but a future administration will almost surely erect an antimissile system.

Although suicide by mankind can almost surely be ruled out, other threats could bring about the demise of humans and most life on this globe. We cannot foresee all possible dangers. Two current concerns are worth mentioning: the impact of a giant meteorite on the earth and the possible destruction of the environment by mankind. Earlier chapters discussed the latter. As for the former, astronomers warn us that small meteoroids are constantly pelting this planet; most burn up harmlessly in the atmosphere. Many scientists contend that very large comets or even stray asteroids have struck the earth in the past wreaking considerable damage on the habitat. Such a collision may have been the proximate cause of the dinosaurs’ extinction. If it happened once, and it appears to have occurred more than once, the earth can suffer another devastating impact. A large collision that led to sufficient ash and particles being thrown into the atmosphere could block sunlight and heat from the surface of the earth for months or perhaps years. The absence of sunshine, together with a sharp drop in temperatures, might annihilate most plants. The effect on agriculture would be catastrophic: food supplies could be cut sharply or in the worst scenarios eliminated. By itself the resulting scramble for nutrition could lead to global conflict and perhaps a nuclear holocaust. Alternatively, if the comet’s winter endured long enough, humans might consume all available edibles and mankind could starve or freeze to death.

Although a giant meteorite might collide with the earth at any time, the probability of destruction’s raining on the planet in any particular year is very low. Mankind probably has more than a few centuries. If progress continues in the interim, science may develop

technologies to mitigate or eliminate the danger. Already engineers are debating methods of diverting or destroying an incoming comet.

As the previous chapter indicated, many environmentalists are prophesying doomsday. Respected governmental leaders are jumping on the bandwagon, proclaiming that mankind is fouling his nest and will destroy our planet. Senate Majority Leader George J. Mitchell recently composed *World on Fire: Saving an Endangered Earth*, in which he foresaw doom for the world barring extreme measures. Despite the hysteria these fanatic environmentalists propagate, no reputable researcher has advanced any evidence that the planet is in danger, that the widespread extinction of many species is likely, or that the postulated destruction of our habitat imperils mankind's existence.

To the contrary, the earth's population is growing; life expectancies are lengthening throughout most of the planet; and, as Chapter 3 documented, what little data exist on the state of the environment demonstrate that nature is in better shape, at least in prosperous areas, than it was only a few decades ago. The probability that the total population of the planet may soon exceed its carrying capacity, as Paul Ehrlich has prophesied, is close to zero. World food production has been outrunning the world's population for decades. Science and technology are likely to continue to improve harvests. The biotechnology revolution has only begun; most of the world's farmers still use relatively primitive techniques, and better practices and seeds could readily multiply production.

Moreover, the growth in the global population will surely slow and probably stop. As people become more affluent, birth rates drop. In virtually all of Europe, in Canada and the United States, in Japan, and in Taiwan, Hong Kong, Korea, and Singapore, the fertility rate is below reproduction. The highest birth rates in the world are in the poorest countries with the lowest rates of economic growth.*

A wealthy economy makes children more expensive and less valuable. High wage countries inflate the opportunity cost of raising children — women's job possibilities in the marketplace multiply. The modern world reduces the value of children as social insurance — as adults they move away and extended families become less common. Technologically advanced countries boost the absolute cost of bringing up a child — more education is needed to compete in the labor market. In all of the countries that have experienced a fall in the birth rate, rapid economic advancement preceded the decline. China, which has

* World Bank statistics show that in 1988 the poorest 42 countries, which comprise 56 percent of the world's population, experienced a fertility rate of 4.0, nearly twice the 2.1 rate which maintains a constant population. If China and India are excluded, this low-income group, which constitutes 19 percent of the global population, realized a fertility rate of 5.6! On the other hand, for the 24 highest-income countries, which contain 15 percent of the world's population, the fertility rate was barely 1.8, well below reproduction levels.

implemented a draconian policy of one-family-one-child, still suffers from a fertility rate above reproduction and considerably greater than that of the much richer Taiwanese or Hong Kongese. If mainland China maintains its extraordinary economic boom of the last few years, birth rates there will almost surely plummet. Calls for lowering the birth rate in impoverished countries put the consequence before the cause.

Only if economic progress stagnates in countries such as China and India would there be any potential for the population eventually to exceed carrying capacities. Even then, the rest of the world could probably grow more than enough foodstuffs to feed those multitudes. Moreover, China and India have already transformed their farming, shifting from food scarcity with periodic famines to being largely self-sufficient and sometimes exporting a surplus. Unless dogmatic communism returns and strangles incentives, agricultural output should be more than adequate.

Progress will doubtless continue for the next few centuries. Science and technology should advance. Some countries will grow rapidly, others will grow more slowly; but, except for those that follow disastrous economic policies or that are continually subject to revolution and war, the world's population should become increasingly prosperous.

Higher standards of living will, in turn, bring demands for more freedom and democracy. Greater affluence will also guarantee a more healthy populace, enjoying longer life spans. Nevertheless, individuals will continue to encounter troubles. The poor will always be with us — although only in a relative sense. Many will feel deprived; some will be unintelligent, inadequate, unable to cope with life. The earth will not have achieved perfection, nor can it. Nations will squabble; politicians will posture; men and women will murder, rob, and cheat.

Democracy will elicit greater demands for equality and for the government to protect people from the vicissitudes of life. As the previous chapter noted, Alexis de Tocqueville concluded that equality breeds a passion for greater equality and that democracy, by reducing the fear of government, enhances a yearning for state protection from the numerous ills of life. Although equal opportunity promotes progress and is only just, equality of outcome, as discussed in the previous chapter, can throttle freedom and economic prosperity. A demand that the bureaucracy protect against the exigencies of life erodes freedom. If the government is to offer this insurance, it must levy heavy taxes, constrain people's actions, and limit opportunities to experiment.

The greatest threat to progress, therefore, stems from the popular demand that government, in the name of a better world, regulate society. Attempts to erase risks and eliminate inequalities are doomed to failure but will curtail economic efficiency and

ultimately strangle growth. The resulting expansion of government narrows liberty, diminishes growth, and hinders progress.

Nevertheless, I remain optimistic. Sweden, Holland, and the other Northern European countries that had proceeded the farthest in dispensing social protection have in recent years attempted to scale back these guarantees. Although they have been largely unsuccessful in diminishing the scope of government, they have more or less stopped its expansion.

The Long Run

The above discussion has focused on the next few decades or at most progress in the twenty-first century. But as was pointed out earlier in this chapter, the cosmos has been evolving since the Big Bang. The universe has grown more complex, more fascinating, and more bountiful. The more we learn of the ways nature functions and the processes by which life developed, the more remarkable they appear. Were the forces of nature slightly stronger or slightly weaker, the world as we know it would not exist and presumably neither life nor intelligence could have evolved.

Astronomers remain puzzled by how the universe arose from an almost smooth beginning with just enough variation to lead to the clumping that produced galaxies, stars, and planets. The origin of life on the primitive earth is a matter of speculation among biologists and organic chemists. We know that very simple single-cell life forms propagated throughout the seas for about a billion years before multicellular organisms arose. Why and how complex plants and animals formed is unknown. Evolution, however, is progress: it invented increasingly sophisticated beings that eventually attained consciousness and intelligence. Intelligent life has emerged only once on this planet; again, why and how is a mystery.

Some look to the hand of God for an explanation. In the past, priests invoked supernatural beings to interpret natural phenomena that science can easily clarify today. Perhaps a creator established the magnitude of the four basic forces of physics, but this defines the Almighty as an accomplished engineer. In fact science has now stripped so much of the mystery away from nature that God's role can, *at the most*, be one of rooting for an outcome and subtly nudging life along a desired track. Since all the lacunae in our understanding of the origins of intelligence appear to be comprehensible in terms of rational science, a Supreme Being retains no necessary task. On the basis of Occam's razor, God is superfluous.

Nevertheless, the progress of the universe appears to be continuous, leading directly towards the development of intelligent life. It is possible that the universe is

meaningless, that life is simply a chance combination of chemicals, that intelligence is a joke on mankind. Physicist Steven Weinberg expressed this nihilistic thought (1977: 154):

> It is very hard to realize that this all is just a tiny part of an overwhelmingly hostile universe. It is even harder to realize that this present universe has evolved from an unspeakably unfamiliar early condition, and faces a future extinction of endless cold or intolerable heat. The more the universe seems comprehensible, the more it also seems pointless.

Whether there is a purpose to the universe and to intelligence may never be known or knowable. A rational position is that it is all chance; there is no design. Nihilism may satisfy some, but the unidirectional development of the cosmos and the amazing number of arbitrary or chance results that have led to mankind hint at the existence of a purpose.

Chance surely could have created the world and produced mankind. Even though the probabilities appear to be extraordinarily small that the laws of physics and random occurrences would evolve *Homo Sapiens*, given enough time in an infinite number of universes that could spring out of an unlimited number of quantum fluctuations, our civilization would arise. If the laws of physics are the only possible laws that could logically be sustained, then the probabilities of life are higher, but the evolution of intelligent beings remains highly unlikely. Nevertheless, since we exist, the universe must be constructed by principles of physics that can generate intelligent life.

As astronomer F. Hoyle points out (1959: 63): "Would it really be sensible then for the laws of science to admit of complex atoms if their existence were never realized?" Moreover, it is quite remarkable that all 90 stable elements have actually been created. By extension, would it be sensible for the laws of physics to enable life and intelligence to develop and for sentient beings not to evolve?

Many observers, including a few scientists (Barrow and Tipler 1986; Hoyle 1959; Davies 1982; Davies 1992) have propounded a teleological view of the universe. Although humans will perhaps never know the long-term aim of intelligent life, these thinkers maintain that the existence of consciousness appears to be essential. According to quantum mechanics, the fundamental theory of subatomic particle physics, nature contains a basic indeterminacy. Either the position or the momentum of an elementary particle, such as an electron, proton, or neutron, can be known, but both cannot be determined at the same time. In fact, what is truly noteworthy is that both are undetermined until one is measured.

It takes consciousness to produce the existence of nature. Without intelligence and consciousness, the cosmos has no existence or exists only in an indeterminate fashion.*

Can mankind be necessary for the cosmos? In *The Anthropic Cosmological Principle*, physicists John Barrow and Frank Tipler emphasized that mankind breathes only because of the particular physics and geography of this universe. Were the cosmos different, human beings could not exist. Therefore, the presence of intelligence requires the type of world we find. Barrow and Tipler describe a weak version of this proposition as follows (16):

> Weak Anthropic Principle: The observed values of all physical and cosmological quantities are not equally probable but they take on values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirement that the Universe be old enough for it to have already done so.

What has been dubbed the strong anthropological principle claims that this universe possesses the properties it displays in order that intelligent life may exist. Only intelligence and consciousness can make the universe physical. Barrow and Tipler defined this premise as (21):

> Strong Anthropic Principle: The Universe must have those properties which allow life to develop within it at some stage in its history.

They advance the following possible interpretations (22):

> (A) There exists one possible Universe 'designed' with the goal of generating and sustaining 'observers.'
>
> (B) Observers are necessary to bring the Universe into being.

and (23):

> Final Anthropic Principle: Intelligent information-processing must come into existence in the Universe, and, once it comes into existence, it will never die out.

These propositions are religious in nature and probably unprovable. However, indirect scientific evidence does offer some support. As professor of Astronomy F. Hoyle maintained (1959):

> I do not believe that any scientist who examined the evidence would fail to draw the inference that the laws of nuclear physics have been deliberately designed with regard to the consequences they produce inside the stars. If this is so, then my apparently random quirks have

* Nobel Prize winner Steven Weinberg disagrees with this position. He holds that even without an observer, the wave dual of particles would exist (1992).

become part of a deep-laid scheme. If not, then we are back again at a monstrous sequence of accidents.

The continuation of mankind and, *inter-alia*, intelligence constitutes progress. For human beings to endure, for intelligence to survive — as far as we know, *Homo Sapiens* constitutes the only intelligent being in the universe — men and women must escape this planet and colonize the galaxy and perhaps the universe. If the human race remains forever trapped on earth, ultimately the sun will swell and obliterate all life on this globe. Before that happens, other catastrophes, such as a collision with an enormous meteorite, a good-sized stray asteroid, or a monstrous wayward comet, could annihilate humanity.

As discussed previously, the probability of a meteoroid crashing into the earth is positive. Recently astronomers have discovered a comet, named Swift-Tuttle, which may collide with the earth on August 14, 2126, with disastrous results, perhaps putting an end to *Homo Sapiens.* Dr. Brian G. Marsden of the Harvard-Smithsonian Center for Astrophysics originally calculated the odds of this doomsday mishap's occurring on that date at 1 in 10,000 (Broad 1992). Subsequent information demonstrates that the six-mile wide ice and rock object has virtually no likelihood of striking the earth before the year 3044 (Broad 1992b). Nevertheless, other large comets could strike the earth within the same period, leading to the end of civilization and perhaps mankind. Moreover, even the later date for a collision with Swift-Tuttle provides mankind with a remaining life expectancy of only a single millennium!

If life on earth is spared a cataclysmic blow from a large extraterrestrial body or extinction from other potential catastrophes, scientists estimate that within 900 million years increased heat from the sun will cause sufficient amounts of the carbon dioxide in the atmosphere to be absorbed by silicate rocks to deprive plants of their essential nutrient (Calderira and Kasting 1992). Without adequate CO_2, all floras will perish, taking with them every animal, including humans.

Some environmentalists claim that economic progress is undesirable or self-destructive. As earlier chapters proved, a halt to economic growth would stop progress and the advance of technology. These visionaries imagine mankind should be content with a small, stable civilization that dwells in harmony with nature. While such a pastoral image has its charms, the end result means the elimination of earth-born life, including human existence. The solar system will end — not soon but eventually. To constrain mankind to economic and scientific stagnation is to condemn humans, and perhaps intelligence in the cosmos, to extinction.

The only way to assure the endurance of intelligence and consciousness is to spread mankind throughout the galaxy. Ultimately that may not be enough as the ultimate fate of

consciousness hangs on the destiny of the cosmos. Astronomers have mapped out three possible scenarios depending on whether there is enough mass in the universe for gravity to overcome the outward momentum of space. If the universe is closed, it will collapse on itself and end in what has been dubbed the "Big Crunch." If the cosmos is open, there is too little matter to stop its outward expansion and it will inflate forever, dying a heat death as entropy grows and heat and energy become ever more diluted. Only if gravity exactly balances the expansion of space — in which case the universe will spread forever but more and more slowly as it approaches a limit — will it be possible for intelligence to flourish for eternity. Scientists have been unable to determine whether it is open or closed, but the best estimates suggest that it is a close call and that it might be either open or closed or *even in-between* (Finkbeiner 1992: 1208).

Fiction writers and a handful of scientists have explored the obstacles, potential, and returns from colonizing the solar system, the galaxy, and ultimately the universe. In their *Selected Symposia Series,* for example, the American Association for the Advancement of Science sponsored an examination of man's role in space. William A. Gale, a scientist specializing on interdisciplinary problems involving physics, economics and statistics at Bell Telephone Laboratories and a consultant to NASA, edited the series and co-authored the chapter on "Models of Long Range Growth." In this compendium, entitled *Life in the Universe: the Ultimate Limits to Growth*, the authors probe the likelihood and barriers to colonization of the solar system and eventually the universe. Gale and Gregg Edwards from the National Science Foundation conclude that the solar system itself can sustain *six trillion* humans and would take about 5,000 years to occupy fully (71). They judge that employing readily available technology will make feasible one-way journeys to colonize the galaxy. Moreover, since life expands to fill all possible niches and since exploration of space is possible, they surmise mankind will ultimately claim the universe.

I can now suggest a possible answer to the meaning of existence: life is necessary to endow the cosmos with reality. The purpose of the human race is to spread throughout the galaxies — to colonize the stars. *Homo Sapiens'* intelligence will equip the universe with an existence and a consciousness. Progress can be measured as steps towards that end. Colonizing the cosmos may seem to many a remote purpose that offers them little immediate emotional satisfaction. It may help to realize that the more familiar objectives of economic growth, scientific advance, improvements in technology, all contribute to this ultimate goal.

Two alternative answers appear to be possible, although others may certainly be formulated. One could propose the existence of a God who has a purpose for the universe

and mankind. Humans may never know His intention, but they should accept on faith the reality of such an aim. Since modern physics leaves little role for the Almighty and since the actuality of the universe, life, and mortals can be understood without resorting to a Supreme Being, I for one would reject relying on any supernatural explanation.

The other alternative is that the universe has no meaning. Thus mankind, life and intelligence comprise a cosmic joke, without an audience to appreciate its black humor. Personally, I find it unappealing to accept that everything we know is the product of chance and without design. As a consequence, I would conjecture that the purpose of life is to provide an intelligence that can observe the universe and therefore give it an existence.

If this be so, it still begs a final question: what is the use of the universe? Even if man is essential for the world, why does the existence of the cosmos matter? For that question, I have no answer.

Conclusions

Progress does not mean achieving paradise on this globe or in this life. Earthly perfection is impossible. Although economic growth may not always bring progress or a real improvement for everyone, it typically elevates some individuals' incomes enough to raise them from grinding poverty and to allow them the leisure and wealth to develop their faculties. Not all or even most will seize the opportunities in creative ways. Nevertheless removing the specter of hunger, cold, heat, and pestilence from the lives of an increasing portion of the world's population constitutes progress.

In the long run, though, human advancement will consist of what the ancient Greeks considered progress: an expansion of knowledge and a reduction in superstition. This growth in understanding of the universe and its ways will make possible new technologies and new opportunities. Even though the concomitant increase in consumer goods may not make people happier or more content, it will open up new opportunities for humans as well as reducing the drudgeries of existence. In the final analysis, however human happiness depends on people's expectations and on their personal relations.

Science and technology will continue to flower, yielding a deeper understanding of the mysteries of the universe and of life and mankind. At a minimum this expansion in knowledge will breed further technological advances that will make it possible for humans to extend their reach to the stars. Ultimately the destiny of the universe and the fate of life may depend on human colonization of the galaxy. If man remains earthbound, life as we know it will disappear. Possibly there is other intelligent life in the universe; possibly not. If not, it would be an unimaginable tragedy to allow life and the only extant intelligence to be wiped out.

It would be extraordinary if the continuous progress that the universe has experienced has been simply the random workings of chance. Perhaps the universe is pointless, but if it is, it would be better not to know or believe it. *Homo Sapiens* needs a purpose, an aim that will give meaning to his or her life. Philosophers have argued that since we know not whether Heaven exists, it is prudent to act as if it did, because if there is no after-life, one loses little, but if there is, one gains an eternity. I would maintain that human beings should assume the purpose of life is to reach the stars and to propagate intelligence throughout the cosmos. There is little to lose by doing so and a universe for eternity to gain.