CHAPTER 3

A BIGGER PICTURE

I can not imagine a God who rewards and punishes the object of Its creation, whose purposes are modeled after our own--a God, in short, who is but a reflection of human frailty.

from Albert Einstein's obituary,
N.Y. Times, April 19,1955

My first trip to Europe was a delight for many reasons, but it held an additional, unexpected treat that wasn't on my itinerary. As my Rome-bound flight cruised at 35,000 feet through crystal clear skies over the Atlantic, I looked out my window at the horizon and was surprised to see *the earth's curvature*. It was ever so slight, but it was there . . . and it really surprised me.

Why? Because by extending the curve in my mind's eye, I could *feel* the enormity of the great circle that bounds our planet. In a very first-hand, personal way, I realized what most people only know intellectually: that in comparison to the six foot high creatures that strut upon its surface, the earth is big.

After some time, my mind switched gears and I began to look at the situation from a whole new perspective. As amazing as the earth is, what with life practically screaming its presence out into the universe, the earth really is only a middling size planet, one of nine relatively minuscule chunks of *stuff* that orbit our star, the Sun.

When people are confronted with this observation, they often respond, "Oh . . . you want big? Try the Sun, it's enormous!"

And they are right . . . sort of. It would take 110 earths to span the Sun's diameter, requiring over 700,000 earths to fill it. Yet as stars go, *it* isn't all that spectacular. For instance, the constellation Orion (the Warrior) has in its left shoulder a star named Betelgeuse. Betelgeuse is a red super-giant

whose diameter varies over a three year period from *400* to *600* times that of our sun. That means that if Betelgeuse were at the center of our solar system, we'd be inside it. It's tough to believe, but our sun is really only a mediocre size star, just one of the *hundred-billion* (100,000,000,000) or so that reside within our galaxy, the Milky Way.

The Milky Way is big. It takes light traveling at 186,000 miles per second approximately 110,000 years to go from one side of the Milky Way to the other. But how *special* is it? Well, . . . it isn't. The Milky Way is a normal size galaxy, just one in the *hundred-billion* galaxies that are in range of the Mt. Palomar telescope (the Palomar telescope uses an seventeen foot reflecting mirror and can pick up the light of a single candle at ten thousand miles--scientists used it to count the number of galaxies that reside in sections of the sky, then extrapolated to get a number for the whole celestial sphere).

I do believe human life--all life for that matter--is wondrous, but as I hurtled toward my European adventure I came to an unwitting conclusion: What we're really talking about when we discuss *mankind in relationship to the cosmos* is an itsy bitsy creature that exists on an absolutely *minuscule bit of nothing* (the earth) that orbits a so-so size star (the Sun) that is one of the *100,000,000,000 stars* in a galaxy that is one of the *100,000,000,000 galaxies* that we know exist.

Having made those observations:

--Does it make sense to expect a Creator with the wherewithal to generate such a minutely complex, yet monumentally immense structure as a universe to pick the highly imperfect residents of one tiny planet to be the pinnacle of Its creation?

--Would you expect a Being of such depth to be so shortsighted and wasteful as to arbitrarily choose a tiny subset of its creation on that planet to be "saved", warts and all, while mysteriously condemning the rest to the suffering of hellfire and damnation? In fact, would you expect a Consciousness on that level to be so ill tempered and impatient as to damn *any* of Its creation for improprieties enacted during one, short, often difficult lifetime?

--Can you envision such a Being as impotent in the face of what we humans rather pathetically call evil?

--Would you expect It to be swayed by prayers that amount to special favors for personal gain?

--And above all, does it make sense that such a Being would go to the trouble of creating a universe like ours without a damn good reason?

It is hard to imagine any Being with the juice to generate the 10,000,000,000,000,000,000,000 plus stars that exist within the universe to act in any of the above mentioned ways, yet many people so believe.

What's more, it is not at all uncommon for humans to intellectually acknowledge a God that is *just* and *all powerful* (assuming one believes in God at all) while *emotionally* approaching that Being the same way primitive societies treated their tribal deities. God is something we pray to for help when we want to get our enemies; we try to make deals with God when we want something that seems out of our reach; we even demand that God forgive us our sins and grant us eternal salvation regardless of whether we deserve it, all the while expecting It to smite those who sin against us.

In short, people's beliefs about God often carry so much confusion and emotional baggage, at least in the face of the immensity of creation, that it is no wonder so many young people have turned away from the old beliefs and taken up instead the banner of atheism.[1]

So let's look at atheism. After all, until now we have said, "God is . . . " The atheists in the crowd have been politely attentive, but all the while they have undoubtedly been thinking, "Yeah, but *does* God exist?"

To address that question, the best place to start is . . . *in the Beginning*.

In the Beginning (the theme of the movie *2001* should swell appropriately here), as far as western science is concerned, there was *absolutely noth-*

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[1] After reading the *first* version of this section, a friend of mine left the following note in the margin: "At this point, some 30-40% (minimum) of your readership decides to use your book for heating fuel . . . I see your point, but I think your presentation may seem to many to be a bit too harsh and hard-hitting a criticism of Christianity."

Please understand that this isn't aimed at Christianity (I thought I had been relatively generic in my discussion--he evidently didn't agree). Most major religions maintain that their followers are especially privileged in their relationship with the Creator; it isn't just Christians who believe themselves *the chosen*.

ing. What existed was a vacuum devoid of structure or time or even radiation (i.e., darkness throughout).

Well, actually, we've already fudged a bit. There was *one* thing that did exist in the beginning. It was energy--the energy wrapped up in the vacuum. And what about that energy?

On the surface, the energy in the primeval void seemed to be evenly distributed, but down at the super, super microscopic level (i.e., around 10^{-34} meters), there were random, quantum mechanical upheavals[2] constantly going on.

This may seem innocuous enough, but what you need to realize is that according to Einstein (and substantiated in physics labs all over the world), energy and matter are two forms of the same thing. It is possible to create a laboratory vacuum in which there is nothing, irradiate it with just the right amount of energy, and out of nowhere will be created two bits of material--a particle and its anti-particle (example: an electron and a positron). You start with nothing and end up with something. Pure energy has turned itself into solid matter. And it goes the other way, too. Put a particle and its anti-particle together and you get what is called annihilation. The particles explode, but not like a normal explosion where the particles break into still smaller pieces. Electrons are elementary particles--they aren't made up of smaller pieces. After the explosion, there is nothing. The particles have ceased to exist, not because they have been blown to smithereens but because they have literally converted themselves from matter into pure energy.

It is fortunate that nature is made that way. Every second the sun takes 657,000,000 tons of hydrogen and fuses it into 653,000,000 tons of helium. What happens to the 4,000,000 tons that are lost in the fusion process? It is turned into pure energy--the energy that bathes our planet in the life-giving radiation that allows us to exist.

The bottom line: if you have energy and the right conditions you have the possibility of creating matter. So going back to "the beginning," the the-

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2 Quantum Mechanics is the study of the dynamics of very small systems--systems at the sub-atomic level. Quantum Mechanical phenomenon is very peculiar. One of those peculiarities is that within extremely confined volumes, energy can fluctuate in ways it could never do in the macroscopic world.

ory holds that an unusually large, radical energy fluctuation occurred by freak chance--a trillion trillion trillion trillion (etc.) to one shot--at this super, super microscopic level. The energy content of the fluctuation was so great that it triggered the creation of a bit of matter. The presence of the matter warped the geometry of the region and, in turn, drew fantastic amounts of free energy to the point. That energy was converted to matter, drawing still more energy. In a rapidly escalating reaction (the whole process took only 10^{-43} seconds to happen), all that would eventually become our physical universe gushed forth in one nearly instantaneous, gigantic BIG BANG.

As described in a 1985 *Astronomy* magazine article entitled "In the Beginning . . . ":

> . . . So we are left with the remarkable possibility that, in the beginning, there existed nothing at all, and that nearly all of the matter and radiation we now see emerged from it. This process has been described by University of California physicist Frank Wilczyk: "The reason that there is something instead of nothing," he said, "is that 'nothing' is unstable." A ball sitting on the summit of a steep hill needs but the slightest tap to see it in motion. A random fluctuation in space is apparently all that was required to unleash the incredible latent energy of the vacuum, creating matter and energy and an expanding universe from quite literally nothing at all.

If the theory is correct, by 10^{-35} seconds all quarks (i.e., the building blocks of protons and neutrons) and leptons (i.e., electrons, etc.) were formed. The size of the universe at that point was 10^{-30} centimeters across and its temperature was ten billion billion billion billion degrees Kelvin.

By 10^{-10} seconds (one ten-billionth of a second), the electromagnetic radiation we associate with light was first manifest as bundles of energy (photons). The diameter of the universe at that point was around one centimeter; the temperature was one million billion degrees Kelvin.

After fourteen minutes, protons were formed. It took 300 more years for the first neutral hydrogen atoms to form, and fifteen to eighteen billion years to get where we are now. The universe at this point is 2.4 million bil-

lion billion miles in diameter (that is $2.4x10^{24}$ miles) and has an average temperature of 3 degrees Kelvin.

Sometime between ten and fourteen billion years after the Big Bang, the first set of stars, then galaxies, formed. Exactly how this occurred is a point of contention within the scientific community today, but generally the idea is simple. As the outward rushing atomic debris from the Big Bang cooled enough to allow gravitational attraction to become a significant player within the realm of cosmic forces, enormous areas of stellar gas began to coalesce into increasingly compact units of material. As the gasses collapsed inward, temperatures at the core skyrocketed. At 10,000,000 degrees Kelvin, hydrogen fusion "ignited" and began to produce helium and enormous amounts of radiated energy . . . a star was born.

The life-cycle of today's second generation stars is much like that of their first generation counterparts. After hundreds of millions of years of hydrogen fusion (the actual time depends upon the size of the star), the supply of hydrogen in the core slowly diminishes leaving mostly helium. In the process, the fusion reaction slows and the core begins to cool and contract. The contraction produces non-nuclear heating. If the star is large enough, the core temperature reaches 100 million degrees Kelvin at which time *helium* fusion begins.

Helium fusion follows a cycle similar to that of hydrogen fusion. For tens to hundreds of millions of years, Helium fuses itself and/or hydrogen to make larger atoms, giving off enormous amounts of energy in the process. Sooner or later the helium in the core begins to exhaust. Nuclear burning slows, the core contracts causing non-nuclear core heat-up, and if the star is again large enough a critical temperature is reached and the prevalent element in the core begins to fuse making still larger atoms.

For the biggest stars, this process can go on all the way up to a core of iron. No healthy star fuses elements larger than iron because iron fusion requires energy *input* instead of providing energy release. Such a process would extinguish the star.

Some stars between ten and twenty solar masses die by exploding. The event is called a supernova. As it occurs, the insides of the exploding star reach temperatures of hundreds of billions of degrees.[3] With these temperatures, all the energy needed to fuse elements *larger* than iron is provided. The *only time* atoms larger than iron are created in nature is during supernovas. That means all the oxygen, gold, uranium, etc., making up our planet was created as a consequence of fusion reactions inside stars that have long since blown to bits.

Physically, you and I and our planet are quite literally made of the stuff of stars.

Science is so pleased with itself over this theory that it can hardly stand it. Why? Because within it, science has accomplished one of its most cherished goals: the presentation of a neat, clean, mechanical model that explains where the universe came from . . . all without the apparent need for a Creator.[4]

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[3] The Crab nebula was created by a supernova that was observed by the Chinese in 1066. The explosion put out 2,000,000 times the normal energy output of the star and was visible *in daylight* for two weeks.

[4] This is a fairly gutsy statement considering we live in a nation populated primarily by God-fearing Christians. Richard Dickerson, an evolutionary molecular biologist who is also a Christian, spoke about this problem of "no need for God" in an article entitled "Letter to a Creationist" published in *The Science Teacher* magazine (September, 1990).

The main thrust of the article was to refute Fundamentalist Christian claims that one's stand on God must either be that "the Bible says it all and it's literally correct," or "science has the last word on everything and it says there is no God." His contention was that there are moderate positions between those extremes. Specifically, he suggests two alternative ways a Christian scientist could treat the dilemma. The first maintains that God created the universe; that the first two chapters of Genesis were meant to be taken figuratively; and that the universe is inherently logical, being God's handiwork, so that any understanding gained by studying it will not probably be grossly wrong. The second maintains that issues about God are private and don't belong within the domain of scientific speculation. Dickerson went on to say that he knows of no scientists who belong to the "science is all" point of view, and that almost all Christian scientists he knows adhere to either of the two alternatives presented above.

The article was great if you happen to find Creationist Theory irritating, but it ignored one important point. Although I'm sure there are scientists who are also devout Christians, the general tone of *most* scientific endeavors nevertheless tends to breed an atheistic, "I don't need God for anything" attitude.

But there are two problems . . . big ones . . . that science has not been able to satisfactorily address: how to explain the *apparent precision* of the universe and how to account for the circumstances that *led* to the Big Bang.

The first difficulty--the precision problem--has two sides to it.

Background: Although it's not something the public is concerned with, physicists in the last eighty years have made remarkable observations concerning the fundamental mathematical constants that intimately relate the natural laws that govern this place.

Light energy, for instance, is something we cannot exist without. But light is very strange. Under certain circumstances, it acts like a *wave* doing things that waves can do but that *particles* could never accomplish (Young's experiment demonstrated this side of light in 1803). Under other circumstances, light acts like a *particle* doing things that particles can do but that *waves* couldn't possibly accomplish (Einstein received a Nobel Prize in the early twentieth century for showing that the photoelectric effect was just such a phenomenon). What this means is that light can act either as a particle-like bundle of energy or as a wave-form of particular frequency, depending upon the situation.

Early in this century, Einstein suggested that the energy (E) of a light particle's bundle and the frequency (n) of its wave-form are directly proportional. In equation form the relationship is E=hn, where *h* is called Planck's constant.

What is interesting is that all of the major physical constants, Planck's constant included, were fixed randomly during the Big Bang, or so it would seem. What is amazing is that if Planck's constant had been set just a tiny bit bigger or smaller, the universe would have evolved in an entirely different way. Stars, for instance, either wouldn't have evolved at all or would have evolved in a highly restricted manner.

In addition, many of the elementary constants, though not physically dependent upon one another, nevertheless act together to effectively support

the universe as we know it. As explained by P.W.C. Davies in his book, The Accidental Universe:

> The numerical values that nature has assigned to fundamental constants, constants such as the charge on an electron, the mass of a proton, the speed of light, the Newtonian gravitational constant, etc., may be mysterious, but they are crucially relevant to the structure of the universe that we perceive. As more and more physical systems, from nuclei to galaxies, have become better understood, scientists have begun to realize that many characteristics of these systems are remarkably sensitive to the precise values of the fundamental constants.
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> More intriguing still, certain crucial structures, such as solar-type stars, depend for their characteristic features on wildly improbable numerical accidents that combine together fundamental constants from distinct branches of physics.
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> Recent discoveries about the primeval cosmos oblige us to accept that the expanding universe has been set up in its motion with a cooperation of astonishing precision.

Please note that the optimal phrases in this eloquent commentary is *wildly improbable numerical accidents* and *cooperation of astonishing precision*.

The problem: "Where did all this precision come from?"

This *apparent-precision* problem becomes even more evident when one looks at life. For example, how did the human body get to the state it is in now, given the fact that there was no life on this planet at the start?

According to one theory[5], things began a billion and a half years ago when electrical storms and intense ultraviolet radiation allowed the predominate chemical compounds in the earth's atmosphere--nitrogen, hydrogen,

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[5] In fact, there are a number of competing theories out today, some more likely than the one about to be presented. That is all right. Whether this is *the true scenario* or not is not important. All we are concerned with here is the GENERAL TREND in scientific thinking concerning the evolution of life.

water and methane--to interact and create complex chemical structures called *amino acids*. Within a few hundred million years, the amino acids had combined to form even more complex molecules--DNA molecules--that were able to act as chemical templates for the replication of themselves (this is similar to the ability of crystalline structures to grow).

The first life form--a virus--was nothing more than a DNA molecule surrounded by a sack of organic molecules called proteins. Over more time, random variations in the coded DNA produced additional proteins called enzymes which in turn allowed the first primitive cellular structures to form. Advanced cells developed as these primitive cells coupled with viruses began to coexist in a symbiotic relationship. Natural selection took things from there.

Mammals appeared approximately two hundred million years ago; Homo Sapiens (early man) came a quarter of a million years ago.

As things stand today, the human body is made up of somewhere around 60,000,000,000,000 (sixty trillion) cells,[6] each of which carries the DNA plan for the entire complex. Each cell knows exactly where it fits into the blueprint, which is fortunate. If that were *not* the case, skin cells on your hand could mistakenly follow the blueprint for cells used in tooth enamel and you would end up with a hand as hard as a rock.

There are *seventy-five thousand miles* of capillaries, veins, and arteries in the body's blood transport system; the heart muscle pumps the equivalent of five hundred thousand *tons* of blood in a normal lifetime.

The lungs are made up of *two hundred fifty million* tiny air sacks, and the body's bone marrow produces *one million* red blood cells every *second*.

There are *one hundred twenty-five million* rod cells per eye with each cell containing *thirty million* molecules of light-catching pigment. The eye can transmit *one and a half million* signals simultaneously to the brain

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[6] How big is sixty trillion? If you had sixty trillion dollars and wanted to spend it, you would have to spend around $350,000 every hour, 24 hours a day, 365 days a year for 2000 years to get rid of your money. That is, if you started at the time of Christ, you'd still have around twenty-four billion dollars left to spend as of January, 1992.

which contains *thirty billion* neurons. Each neuron can be connected to as many as *eighty thousand* other neurons at once.

The body's DNA provides the immune system with the capacity to produce over *one billion* antibodies allowing the body the potential to fight off diseases that don't even exist yet. The liver can perform over *five hundred* tasks, some of which can not by duplicated today within our finest chemical laboratories, and produces over *one thousand* different enzymes. Without its services, we would not be able to detoxify such poisonous materials as nicotine, caffeine, alcohol, and the myriad of other "food products" we human seem to indiscriminately ingest on a regular basis.

As each body part is enormously intricate within itself, when laced together into "the system," the living machine we end up with is absolutely beyond belief. Through the agency of a number of very sophisticated systems (the nervous system, the digestive system, the lymph system, etc.) the body has the ability to coordinate the activities of its very different, very independent parts (the liver, kidneys, brain, not to mention the astronomical number of individual cells that work together to make up these parts) in such a way as to allow it to survive *without any conscious effort on your part*.

It would take a large library to catalogue all we currently know about how the body works. It would probably take a city of libraries to catalogue all we don't know.

With all this in mind, think now about that nice, clean, tidy theory of evolution science has laid before us. Noting that nature doesn't appear to migrate toward complexity on its own--science suggests that, if anything, it tends toward disorder (thermodynamic entropy)--what are the odds against something as remarkably complex as a human being evolving by pure chance from nothing more than *four molecular compounds and some lightning*?

A mid-1980 *Science News* article announced the revised results of two university professors who had calculated the odds that humankind could have evolved to its current point from scratch, so to speak. The old estimate was one chance in 1,000,000,000,000,000,000,000,000 (that is, one in one-tril-

lion-trillion).[7] By doing some clever assuming, the professors had gotten it down to a more respectable one chance in 100,000,000,000,000 (one-hundred-trillion).[8]

Put another way, you'd have a better chance of taking a cargo plane to 10,000 feet, dumping a half million bricks and five tons of mixed concrete out its bay doors, then expect to find the bricks landing *by chance* in such a way as to construct a completely finished, two story, old-English style home, complete with patio and Jacuzzi appropriately situated in the back yard.

Bottom line: As impressive as the aura of knowledge and rightness is around most scientific theories, science's *evolution by chance* scenario is so fantastically improbable that it ranks right up there with the literal version of *God made the world in seven days*.

The *second major drawback* to science's Big Bang theory takes considerably less explanation but is potentially much more damaging.

The *energy* that supported the primeval vacuum . . . where did it come from? We know how the energy was stored--in the nothingness that existed before time and space came into being. But for the life of us, we don't have a clue as to where all that initial energy came from in the first place.

In short, we really haven't *explained* the beginning at all.

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[7] That is probably surprising, given the number of stars that exist within the universe, but not all stars are in a position to handle life-bearing planet. Planets in binary and trinary star systems (ie, solar-type systems that have two or three stars in them) don't have the temperature stability required to support life (the temperature of a planet in such a system will be dependent upon where the planet is at a given instant, relative to the stars in the system). Of the single-star system, not all have planets. Of those with planets, not all have planets the appropriate distance from the star (planets that are too far away would freeze; planets too close would boil). Of the systems with planets at the appropriate distance, not all of those planets have atmospheres. Of those with atmospheres, not all have the right proportion of gasses.

[8] What is interesting is that if those same mathematicians had calculated the odds that *psychic phenomena* might be a reality, and if they had found it to be one chance in a million, they would surely have condemned as insane anyone who, in the face of those odds, still professed a belief in psychic phenomenon. Yet in perfect sincerity, scientists preach the belief that mankind evolved by chance from practically nothing . . . *hundred-trillion to one odds* and all.

What does it all mean?

For the atheists in the crowd: The Big Bang most probably happened; Darwin's theory of *natural selection* and the mechanism for evolution espoused by modern-day biologist's are probably on-target. But for life to have evolved as it has, given its complexity, the odds are that there was more than *random chance* acting.[9] It is almost certain that there had to be an impetus, a plan, a Creator involved.

And for the religious folks in the crowd: Considering the power and insight required of a Creator able to put together something as immense and complex as a universe, the chance that that Being is *anything at all* like the God Western religions believe in is highly unlikely.

In other words, I've probably managed to irritate just about everyone.

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[9] It is interesting to note that observations like these have drawn a considerable number of young scientists from the ranks of atheism to the ranks of agnosticism. That is, they aren't willing to say that God exists, but they are equally unwilling to say that God doesn't exist. In short, they are bright and honest enough to realize that they just don't know.