

Wired 10.12: The New Convergence

Issue 10.12 - December 2002

The New Convergence

By Gregg Easterbrook

The ancient covenant is in pieces: Man knows at last that he is alone in the universe's unfeeling immensity, out of which he emerged only by chance." So pronounced the Nobel Prize-winning French biologist Jacques Monod in his 1970 treatise *Chance and Necessity*, which maintained that God had been utterly refuted by science. The divine is fiction, faith is hokum, existence is a matter of heartless probability — and this wasn't just speculation, Monod maintained, but proven. The essay, which had tremendous influence on the intellectual world, seemed to conclude a millennia-old debate. Theology was in retreat, unable to explain away Darwin's observations; intellectual approval was flowing to thinkers such as the Nobel-winning physicist Steven Weinberg, who in 1977 pronounced, "The more the universe seems comprehensible, the more it also seems pointless." In 1981, the National Academy of Sciences declared, "Religion and science are separate and mutually exclusive realms of human thought." Case closed.

And now reopened. In recent years, Allan Sandage, one of the world's leading astronomers, has declared that the big bang can be understood only as a "miracle." Charles Townes, a Nobel-winning physicist and coinventor of the laser, has said that discoveries of physics "seem to reflect intelligence at work in natural law." Biologist Christian de Duve, also a Nobel winner, points out that science argues neither for nor against the existence of a deity: "There is no sense in which atheism is enforced or established by science." And biologist Francis Collins, director of the National Human Genome Research Institute, insists that "a lot of scientists really don't know what they are missing by not exploring their spiritual feelings."

Ever so gingerly, science has been backing away from its case-closed attitude toward the transcendent unknown. Conferences that bring together theologians and physicists are hot, recently taking place at Harvard, the Smithsonian, and other big-deal institutions. The American Association for the Advancement of Science now sponsors a "Dialogue on Science, Ethics, and Religion." Science luminaries who in the '70s shrugged at faith as gobbledygook — including E. O. Wilson and the late Stephen Jay Gould and Carl Sagan — have endorsed some form of reconciliation between science and religion.

Why the renewed scientific interest in spiritual thinking? One reason is the cyclical nature of intellectual fashions. In philosophy, metaphysics is making a comeback after decades ruled by positivism and analytical theory of language. These restrained, empirically based ideas have run their course; now the pendulum is swinging toward the grand vision of metaphysics — someday, surely, to swing away again. Similarly in science, the pure materialistic view that reigned through the 20th century, holding that everything has a natural explanation, couldn't keep other viewpoints at bay forever. The age-old notion that there is more to existence than meets the eye suddenly looks like fresh

thinking again.

Meanwhile, decades of inconclusive inquiry have left the science-has-all-the-answers script in tatters. As recently as the '70s, intellectuals assumed that hard science was on track to resolve the two Really Big Questions: why life exists and how the universe began. What's more, both Really Big Answers were assumed to involve strictly deterministic forces. But things haven't worked out that way. Instead, the more scientists have learned, the more mysterious the Really Big Questions have become.

Perhaps someday researchers will find wholly natural explanations for life and the cosmos. For the moment, though, discoveries about these two subjects are inspiring awe and wonder, and many scientists are reaching out to spiritual thinkers to help them comprehend what they're learning. And as the era of biotechnology dawns, scientists realize they're stepping into territory best navigated with the aid of philosophers and theologians. We are entering the greatest era of science-religion fusion since the Enlightenment last attempted to reconcile the two, three centuries ago.

Look up into the night sky and scan for the edge of the cosmos. You won't find it — nobody has yet. Instruments such as the Hubble Space Telescope's deep-field scanner have detected at least 50 billion galaxies, and every time the equipment is improved, more galaxies farther away come into focus. Space may be infinite — not merely vast, but infinite — encompassing an infinite number of galaxies with an infinite number of stars.

All this stuff — enough to form 50 billion galaxies, maybe fantastically more — is thought to have emerged roughly 14 billion years ago in less than a second, from a point with no physical dimensions. Set aside the many competing explanations of the big bang; something made an entire cosmos out of nothing. It is this realization — that something transcendent started it all — which has hard-science types such as Sandage using terms like "miracle."

Initially, scientists found the big bang's miraculous implications off-putting.

When, in 1927, Catholic abbé and astronomer Georges Lemaître first hypothesized that existence began with the detonation of a "primordial atom" of infinite density, the idea was ridiculed as a transparent ploy to place Genesis on technical grounding. But Lemaître enclosed a testable prediction — that if there had been a bang, the galaxies would be rushing away from one another. This idea, too, was ridiculed, until Edwin Hubble stunned the scientific world by presenting evidence of cosmic expansion. From Hubble's 1929 discovery on, science has taken big bang thinking seriously.

In 1965, another sort of big bang echo — the cosmic background radiation — was discovered. Soon, it was assumed, cosmologists would be able to say, "Here's how everything happened, steps one, two, and three." Today cosmologists do think they know a fair amount about steps two and three — what the incipient cosmos was like in the instant after the genesis, how matter and energy later separated and formed the first galaxies. But as for step one, no dice. Nobody knows beyond foggy conjecture what caused the big bang, what (if anything) was present before that event, or how there could have been a prior condition in which nothing existed.

Explanations of how the mass of an entire universe could pop out of a void are especially unsatisfying. Experiments announced in July this year by the Brookhaven National Laboratory in New York measured properties of subatomic particles known as muons, finding that they behave as though influenced by other particles that seem to have materialized from nothingness. But no object larger than the tiniest subatomic particle has been observed to do this — and these "virtual" particles are volatile entities that exist for less than a second,

while the big bang made a universe that is superbly stable, perhaps even permanent.

About 10 years ago, just as scientists were becoming confident in big bang theory, I asked Alan Dressler — one of the world's leading astronomers, and currently a consultant on the design of the space telescope scheduled to replace the Hubble — what caused the bang. He scrunched his face and said, "I can't stand that question!" At the time, cosmologists tended to assert that the cause and prior condition were unknowable. The bizarre physics of the singularity that preceded the explosion, they explained, represented an information wall that blocked (actually, destroyed) all knowledge of the prior condition and its physical laws. We would never know.

The more scientists testily insisted that the big bang was unfathomable, the more they sounded like medieval priests saying, "Don't ask me what made God." Researchers, prominently Alan Guth of MIT, began to assert that the big bang could be believed only if its mechanics could be explained. Indeed, Guth went on to propose such an explanation. Suffice it to say that, while Guth asserts science will eventually figure out the cause, he still invokes unknown physical laws in the prior condition. And no matter how you slice it, calling on unknown physical laws sounds awfully like appealing to the supernatural.

The existence of 50 billion galaxies isn't the only mystery that's prompting scientists to rethink their attitudes toward the divine. Beyond this is the puzzle of why the universe is hospitable to living creatures.

In recent years, researchers have calculated that if a value called ω — the ratio between the average density of the universe and the density that would halt cosmic expansion — had not been within about one-quadrillionth of 1 percent of its actual value immediately after the big bang, the incipient universe would have collapsed back on itself or experienced runaway-relativity effects that would render the fabric of time-space weirdly distorted. Instead, the firmament is geometrically smooth — rather than distorted — in the argot of cosmology. If gravity were only slightly stronger, research shows, stars would flame so fiercely they would burn out in a single year; the universe would be a kingdom of cinders, devoid of life. If gravity were only slightly weaker, stars couldn't form and the cosmos would be a thin, undifferentiated blur. Had the strong force that binds atomic nuclei been slightly weaker, all atoms would disperse into vapor.

These cosmic coincidences were necessary to create a universe capable of sustaining life. But life itself required an equally unlikely fine-tuning at the atomic level, yielding vast quantities of carbon. Unlike most elements, carbon needs little energy to form exceedingly complicated molecules, a requirement of biology. As it happens, a quirk of carbon chemistry — an equivalence of nuclear energy levels that allows helium nuclei to meld within stars — makes this vital element possible.

To the late astronomer Fred Hoyle, who calculated the conditions necessary to create carbon in 1953, the odds of this match occurring by chance seemed so phenomenally low that he converted from atheism to a belief that the universe reflects a "purposeful intelligence." Hoyle declared, "The probability of life originating at random is so utterly minuscule as to make the random concept absurd." That is to say, Hoyle's faith in chance was shaken by evidence of purpose, a reversal of the standard postmodern experience, and one shared by many of his successors today.

This web of improbable conditions — making not just life but intelligent life practically inevitable — came to be known as the anthropic principle. To physicist Charles Townes, an anthropic universe resolves a tension that has

bedeviled physics since the heyday of quantum theory. "When quantum mechanics overthrew determinism, many scientists, including Einstein, wanted the universe to be deterministic," he points out. "They didn't like quantum theory, because it leaves you looking for a spiritual explanation for why things turned out the way they did. Religion and science are going to be drawn together for a long time trying to figure out the philosophical implications of why the universe turned out favorable to us."

Of course, not every scientist is ready to don choir robes. Hard science's attempt to explain our anthropic universe without any reference to the divine has led to the emerging theory of the multiverse, or multiple universes. Andrei Linde, a researcher at Stanford, has argued for a decade that the big bang wasn't unique. Universes bang into existence all the time, by the billions. It just happens in dimensions we can't see.

Linde starts from the assumption that if the big bang was a chance event driven by some natural mechanism, then such events can be expected to happen repeatedly over eons. Ergo, billions of universes. With each bang, Linde supposes, physical laws and constants are determined anew by random forces. Huge numbers of universes end up with excessive gravity and are crushed out of existence; huge numbers end up with weak gravity and no stars; huge numbers lack carbon. Once in a while, an anthropic cosmos comes about.

Several variations on the multiverse theory are popular in academia because they suggest how our universe could have beaten the odds without a guiding hand. But the multiverse idea rests on assumptions that would be laughed out of town if they came from a religious text. Townes has said that speculation about billions of invisible universes "strikes me as much more freewheeling than any of the church's claims." Tenured professors at Stanford now casually discuss entire unobservable universes. Compare that to religion's proposal of a single invisible plane of existence: the spirit.

Linde admits that we can't observe or verify other universes in any way; for that matter we can't even explain how they might occupy alternate dimensions. (As a scientific concept, extra dimensions are ambiguous at best; none beyond the familiar four have ever been observed, and it's far from clear that a higher number is possible.)

Thus, the multiverse theory requires as much suspension of disbelief as any religion. Join the church that believes in the existence of invisible objects 50 billion galaxies wide! To be fair, the dogmas embraced by science tend to be more flexible than those held by theologians. If empirical evidence of God were to appear, science probably would accept it eventually, if grudgingly; while religion, if presented with an empirical disproof of God, might simply refuse to listen. Nevertheless, while cosmology seems more and more to have a miraculous aspect, the scientifically approved alternatives require an article of faith.

Numerous other areas of contemporary science sound like supernaturalism dressed up. Researchers studying the motions of spiral galaxies have found that the stars and gas clouds within them behave as though they're subject to 20 times more force than can be explained by the gravity from observed matter. This has led to the assumption — now close to a scientific consensus — that much of the cosmos is bound up in an undetectable substance provisionally called dark matter. The ratio of dark to regular matter may be as high as 6 to 1.

Other experiments suggest that as much as two-thirds of the content of the universe may crackle with an equally mysterious dark energy. In 1998, astronomers were surprised to discover that, contrary to expectations, cosmic expansion isn't slowing as the momentum of the big bang peters out. Instead, it appears to be speeding up. Something very powerful is causing the galaxies to

fly apart faster all the time.

Then there's the Higgs field. In an attempt to explain the ultimate source of mass, some theorists propose that the universe is permeated by an undiscovered field that confers mass on what would otherwise be zero-mass particles. The Superconducting Supercollider project, canceled in 1993, was intended to test this hypothesis.

These and other mystery forces seem to function based on nothing. That notion, now a fact of life among physicists and cosmologists, would have been considered ridiculous just a few generations ago. Yet Judeo-Christian theology has been teaching for millennia that God made the universe *ex nihilo* — out of nothing. Maybe these forces work in a wholly natural manner that simply hasn't yet been determined. Certainly, there's a better chance of finding observational evidence for theories of physics than theories of theology. But for the moment, many believers find physics trending in their direction, while physicists themselves are left to ponder transcendent effects they can't explain.

Physicists and theologians hold chummy conferences and drink sherry together, but most biologists still want little to do with spiritual thought, and the feeling is mutual on the part of many believers. More than three-quarters of a century after John Scopes stood trial for teaching evolution, Darwin's theory remains a flash point. Only in September, creationists urged Congress to enact legislation supporting the teaching of alternatives to evolution in public schools.

The battle between evolutionary biology and faith isn't inevitable. As genome researcher Collins says, "I am unaware of any irreconcilable conflict between scientific knowledge about evolution and the idea of a creator God. Why couldn't God use the mechanism of evolution to create?" Mainstream Protestant denominations and most branches of Judaism accept Darwin, and in 1996, Pope John Paul II called Darwin's work "more than just a hypothesis."

Even Christian fundamentalism wasn't always anti-Darwin. When the American movement began at the start of the 20th century, its trumpet call was a popular series of pamphlets called *The Fundamentals*, which were to the decade of the 1910s what the *Left Behind* series of evangelical novels is today. According to *The Fundamentals*, evolution illustrated the subtle beauty of God's creative power.

The tide began to turn a decade later, however, when William Jennings Bryan began preaching against Darwinism. He was influenced by a 1923 book, *The New Geology*, which argued that Earth's apparently ancient age was an artifact created by God to test people's faith. Moreover, Bryan had just spent a year in Germany and was horrified by the incipient Nazi movement, which used social Darwinism — now discredited, but then fashionable on the left as well as the right — to assert that it was only natural for the strong to kill the weak. His crusade against evolutionary theory led to the Scopes trial in 1925, which cemented into American culture the notion that Darwin and religion were opposing forces.

Espousing a theory known as intelligent design, molecular biologist Michael Behe and others are attempting to forge a synthesis. Often — though inaccurately — described as creationism lite, intelligent design admits that evolution operates under current conditions but emphasizes that Darwin is silent on how those conditions came to be. Science doesn't have the slightest idea how life began. No generally accepted theory exists, and the steps leading from a barren primordial world to the fragile chemistry of life seem imponderable.

The late biologist Gerald Soffen, who oversaw the life-seeking experiments carried out by NASA's Viking probes to Mars, once outlined the early milestones

in the evolution of living processes: development of organic compounds, self-replication of those compounds, appearance of cells isolating the compounds from their environment, photosynthesis enabling cells to use the sun's energy, and the assembly of DNA. "It's hard to imagine how these things could have happened," Soffen told me before his death in 2000. "Once you reach the point of a single-cell organism with genes, evolution takes command. But the early leaps — they're very mysterious."

Intelligent design trades on this insight to propose that only a designer could create life in the first place. The theory is spiritual, but it's not bound by Scripture, as creationism is. A designer is a nondenominational, ecumenical possibility, not a dogmatic formula.

Did a designer set Earth's life processes in motion? Few questions are more interesting or intellectually rich. Because the evolution debate is so rancorous, however, the how-did-life-begin question is usually lost amid shouting matches between orthodox Darwinians and hard-line creationists. The biotech era may change this. Biologists and fundamentalists may still want to hurl bricks at one another, but there's no dodging the immediate questions of biological engineering, stem-cell research, transgenic animals, and so on. What is life? Do individual cells have rights? Do human beings have the right to alter human DNA? Is it wise to reengineer the biosphere?

The need to grope our collective way through such quandaries may force theologians, church leaders, biologists, and philosophers to engage one another. Perhaps this debate will get hopelessly hung up in doctrine, for instance on the question of whether life begins when sperm meets egg. But there is at least an equal chance that the pressure of solving biotech questions will force science and theology to find the reasonable points of either field. Unlike cosmology, which poses fascinating questions whose answers have no effect on daily life, biotech will affect almost everyone in an immediate way. A science-and-religion reconciliation on this subject may be needed to write research rules, physician ethics, and, ultimately, law.

Oh, and what did Einstein think about this issue? He said, "Science without religion is lame, religion without science is blind." Einstein was neither convinced there is a God nor convinced there is not; he sensed that it's far too early in the human quest for knowledge to do more than speculate on transcendent questions. Science, which once thought the case for higher power was closed, is now trending back toward his view.

Gregg Easterbrook is a contributing editor for The Atlantic Monthly and author of the book *The Here and Now*.

Copyright © 1993-2002 The Condé Nast Publications Inc. All rights reserved.

Copyright © 1994-2002 Wired Digital, Inc. All rights reserved.