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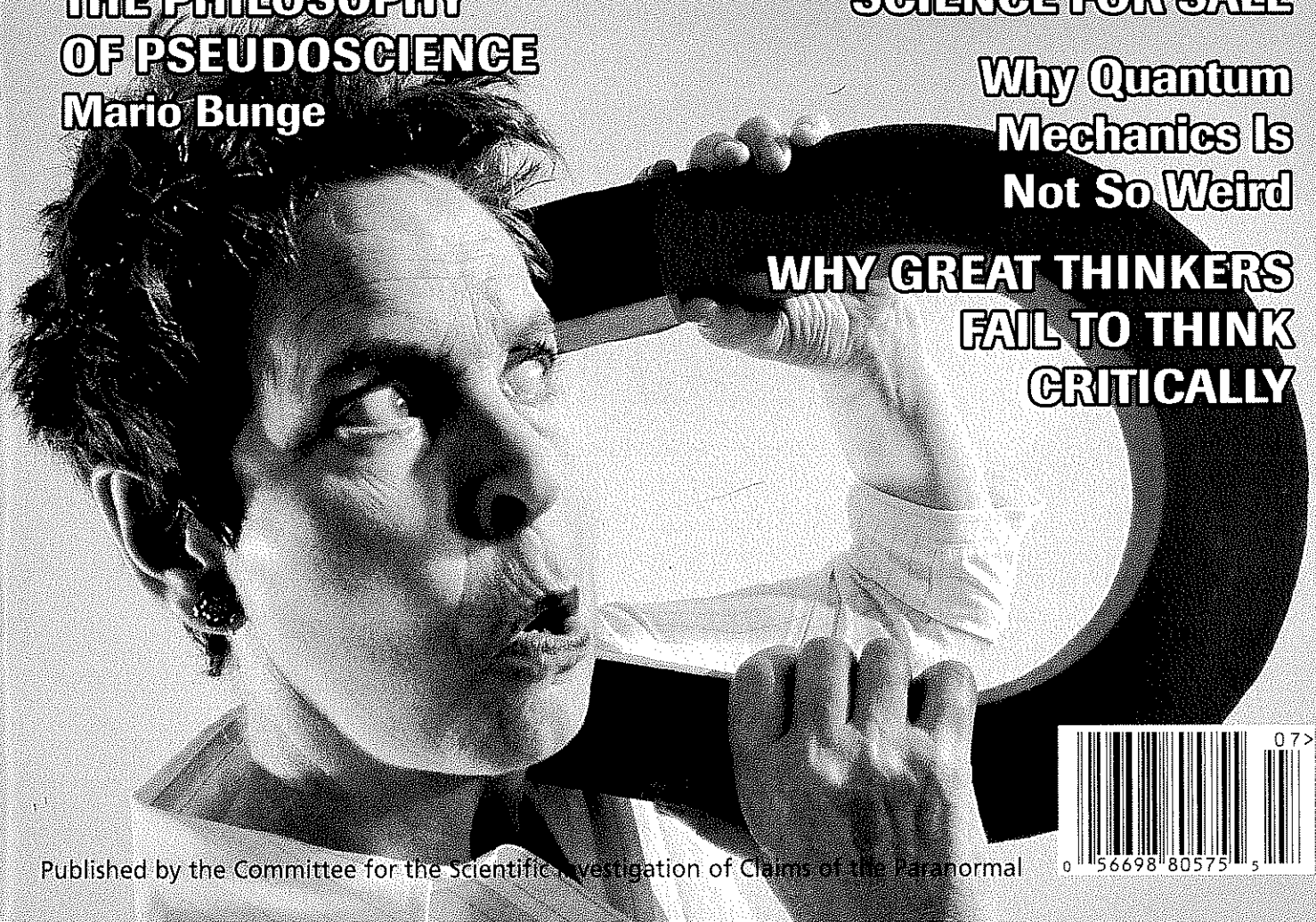
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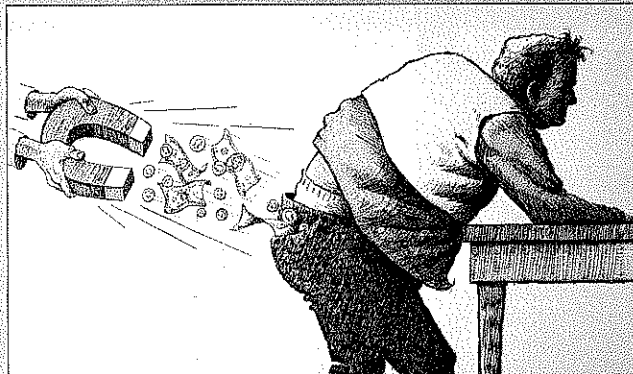
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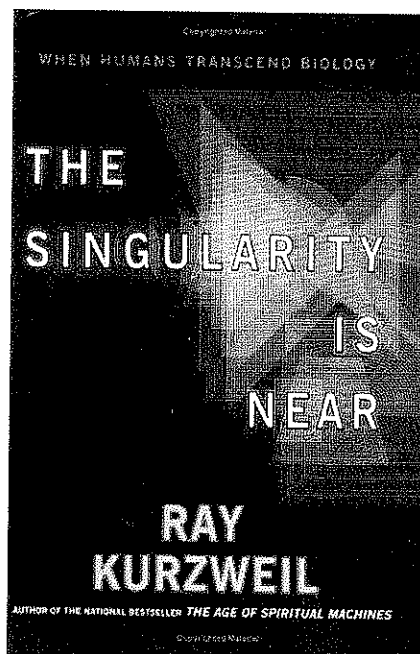
Evolution's Radical Future

JAMES N. GARDNER

The Singularity Is Near: When Humans Transcend Biology. By Ray Kurzweil. Viking, New York, 2005. ISBN 0-67003384-7. 672 pp. Hardcover, \$29.95.

If Charles Darwin were alive today and aware of the truly revolutionary trends occurring in what might be called the extended terrestrial biosphere (i.e., the totality of all life on Earth plus all of life's artifacts, a similar but more limited concept of which was articulated by Richard Dawkins in *The Extended Phenotype*), he would surely conclude that the sturdy engine of evolution, its vital force undiminished by the passage of centuries, is poised to effect a change perhaps as important as the Cambrian Explosion half a billion years ago. Darwin would likely conclude as well that *artificial* selection—of which he made artful metaphorical use in *The Origin of Species* to illustrate his hypothesis of speciation through natural selection—has, in our modern era, virtually displaced *natural* selection as evolution's key propellant, at least with respect to the future pathway of human biological development. And the theorist would doubtless contemplate with awe the abiding reality that deep geological time—the enormous stretch of millennia that utterly dwarfs a human lifespan and challenges the very capacity of our biologically evolved human imagination

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to conceive of its vastness—remains the vital arena in which evolution's epic story continues to unfold.

But Darwin would immediately recognize that there is a crucial difference between the process of natural selection as it operated in the distant past and the novel possibilities currently open to the evolutionary process. He would conclude that, while a vision of time's immensity remains the vital key in reaching an understanding of evolution's radical potential, it is a realization of the fathomless magnitude of *future time* and *future history* that is of utmost importance today. A modern Darwin would concur with the conclusion of physicist John Wheeler: Most of the time avail-

able for life and intelligence to achieve their ultimate capabilities lies in the distant cosmic future, not in the cosmic past. As cosmologist Frank Tipler has bluntly stated, "Almost all of space and time lies in the future. By focusing attention only on the past and present, science has ignored almost all of reality. Since the domain of scientific study is the whole of reality, it is about time science decided to study the future evolution of the universe."

Although you won't read about in any *New York Times* or *Wall Street Journal* headline, the disruptive potential of future evolution is the emerging leitmotif in advanced biological theorizing today. The current intelligent design dust-up on which the popular press myopically focuses will turn out to be a minor historical footnote to the portentous evolutionary drama soon to reveal itself.

Darwin's ghost is unlikely to grace us with a timely appearance, but happily a satisfactory substitute is available: Ray Kurzweil, author of a magisterial new book entitled *The Singularity Is Near: When Humans Transcend Biology*. Kurzweil is a computer scientist, prolific inventor, and gifted futurist best known for his two previous bestsellers about artificial intelligence—*The Age of Intelligent Machines* and *The Age of Spiritual Machines*. Bill Gates' enthusiastic blurb for Kurzweil's latest tome proclaims that "Ray Kurzweil is the best

person I know at predicting the future of artificial intelligence,” and MIT guru Marvin Minsky gushes that this is “a brilliant book with deep insights into the future from one of the leading futurists of our time.” This fulsome praise may be on the mark but it misses the most important point about Kurzweil’s current contribution. *The Singularity Is Near* is not primarily a set of predictions about the future of computing or even technology in general. Rather it is a uniquely well-informed, technically literate, and blindingly honest speculation about the very future of evolution itself. *Singularity* is a book that Charles Darwin would have written were he steeped in the ongoing technological revolution that is engulfing our world. As such, it should be required reading for anyone seriously interested in exploring what lies over the horizon in life’s journey from primordial bacterium to transcendent mind.

What’s coming next on the evolutionary road, Kurzweil believes, can be inferred from a set of overlapping trends summarized in the 1950s by the legendary information theorist John von Neumann: “The ever-accelerating progress of technology . . . gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue.”

This scary quotation is, in Kurzweil’s view, the key to understanding the future of evolution:

Von Neumann makes two important observations here: *acceleration* and *singularity*. The first idea is that human progress is exponential (that is, it expands by repeatedly *multiplying* by a constant) rather than linear (that is, expanding by repeatedly *adding* a constant). The second is that exponential growth is seductive, starting out slowly and virtually unnoticeably, but beyond the knee of the curve it turns explosive and profoundly transformative. The future is widely misunderstood. Our forebears expected it to be pretty much like their present, which had been pretty much like their past. Exponential trends did exist one thousand years ago, but they

were at that very early stage in which they were so flat and so slow that they looked like no trend at all. As a result, observers’ expectation of an unchanged future was fulfilled. Today, we anticipate continuous technological progress and the social repercussions that follow. But the future will be far more surprising than most people realize, because few observers have truly internalized the implications of the fact that the rate of change itself is accelerating.

What specifically can we anticipate from this process of accelerating change in the near future? What does the coming era of the “singularity”—defined by Kurzweil as “a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed”—hold in store for humanity?

First and foremost, the fusion of human and machine intelligence. In the post-Singularity era, Kurzweil predicts, there will no distinction between human beings and their technologies. As we merge with our machines, we will become something more than merely human. The Borg-like hybrid entity that is our evolutionary destiny will, in Kurzweil’s words, “match and then vastly exceed the refinement and suppleness of what we regard as the best of human traits.” But, alas, from the “perspective of unenhanced biological humanity” this future state of affairs “will appear to rupture the fabric of human history.” The only thing that will remain unequivocally human in such a world will be what Kurzweil regards as the defining trait of our humanity: the instinct to “extend [humankind’s] physical and mental reach beyond current limitations.”

The limitations that we will transcend will be mental as well as physical. Kurzweil forecasts that we will have personal computer-sized devices capable of emulating human-level intelligence within two decades and effective software models of human thought processes by the mid-2020s. Once machines achieve this level of sophistica-

tion and are given the power to improve their own designs, they will inevitably rush past our slower biological brains, achieving mental skills that we can scarcely imagine.

Is this radical vision truly as dystopian as it appears—the end of humanity as we know it? Kurzweil offers a coy answer:

The intelligence that will emerge [post-Singularity] will continue to represent the human civilization, which is already a human-machine civilization. In other words, future machines will be human, even if they are not biological. This will be the next step in evolution, the next high-level paradigm shift. . . . Most of the intelligence of our civilization will ultimately be nonbiological. By the end of this century, it will be trillions of trillions of times more powerful than [unenhanced] human intelligence. However, to address often-expressed concerns, this does not imply the end of biological intelligence, even if it is thrown from its perch of evolutionary superiority. Even the nonbiological forms will be derived from biological design. Our civilization will remain human—indeed, in many ways it will be more exemplary of what we regard as human than it is today, although our understanding of the term will move beyond its biological origins.

Just how far will our nonbiological progeny move beyond those origins? In Kurzweil’s exuberant view, very far indeed. In fact, he predicts that the ultimate destiny of brainy thinking machines will be to saturate the entire universe with intelligence:

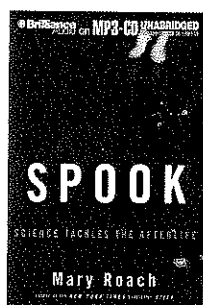
In the aftermath of the Singularity, intelligence, derived from its biological origins in human brains and its technological origins in human ingenuity, will begin to saturate the matter and energy in its midst. It will achieve this by reorganizing matter and energy to provide an optimal level of computation . . . to spread out from its origin on Earth. . . . [T]he “dumb” matter and mechanisms of the universe will be transformed into exquisitely sublime forms of intelligence. . . . This is the ultimate destiny of the Singularity and of the universe.

In short, a capacity to engage in “intelligent design” of the entire universe is the predicted culmination of the biological and technological evolutionary process that began, so long ago, right here on humble planet Earth.

Kurzweil does not, in the style of the ID community, pose such a capability as a challenge to Darwinian orthodoxy. On the contrary, the ultimate capacity of intelligence is presented as an extension and refinement of Darwin’s classic proposition that nature’s organized complexity can be explained pri-

marily on the basis of natural selection. According to Kurzweil’s worldview, the emergent ability of intelligence to configure and manipulate matter with ever-increasing sophistication is the hypothesized end result of an evolutionary process that begins with “dumb” Darwinian natural selection, passes through a technology-creating threshold (which corresponds to our current era), and culminates with the triumph of highly evolved mind over matter and the transcendence of the “dumb” forces of inanimate nature.

Kurzweil’s brave vision is in the spirit of Charles Darwin’s historic theory—an entirely plausible and utterly iconoclastic analysis of life’s seemingly miraculous capacity to yield, in Darwin’s unforgettable phrase, “endless forms most beautiful and most wonderful” through fully naturalistic means. The fact that, like Darwin, Kurzweil tends to demote humanity from the centerpiece of creation to a supporting role in the vast emerging spectacle of the cosmos is perhaps his greatest intellectual virtue.



The Big Sleep or Just a Nap?

GREG MARTINEZ

Spook: Science Tackles the Afterlife. By Mary Roach. W.W. Norton & Company, New York, 2005. ISBN 0-393-05962-6. 311 pp. Hardcover, \$24.95.

Dr. Kirti S. Rawat is the director of the International Centre for Survival and Reincarnation Research. A retired philosophy professor from the University of Rajasthan, as depicted by Mary Roach in her sharp and witty *Spook: Science Tackles the Afterlife*, he seems less a scientific researcher than a minor character from a V. S. Naipaul novel, sprung to a guileless and dithery life.

He serves as Ms. Roach’s guide through the “discipline” of reincarnation research, but also serves as travel agent. He switches their hotel after just a night’s stay in Dehli to the place where he camped with famed reincarnation researcher/popularizer Ian Stevenson (whose work was dissected in these pages in 1994) while they worked together. Roach lists the hotel’s notable deficiencies, but “Dr. Rawat likes the vegetarian dinners, and the service is attentive to the point of preposterous-

ness.” He is a take-charge kind of guy, and clearly prefers that role. He arranges a car and driver for them, but the car is a 1965 Ambassador. Rawat admits that the car is “beginning to be outmoded,” but what he really likes is the driver: “He is submissive. Generally, I like people who are submissive.”

He also appears to like flimsy stories and giving people immense benefit of doubt while entertaining their stories of past lives. Roach dutifully follows in his wake for several days, trudging through (and losing shoes in) mud and dirt to get to the remote houses in which Rawat has found subjects for his research. In spite of the fact that these stories are utterly lacking in substance and proof, Rawat soldiers on through his interviews and questionnaires, gathering data and information in what he resolutely believes is the interest of science.

Rawat is only the first of dozens of intrepid individuals profiled in this smart and often hilarious volume. The cast of characters includes professional scientists, dedicated amateurs, inspired fools, and outright kooks, all following

rather dubious paths that try (in vain) to apply the rigors of scientific inquiry to questions that fall solidly out of the scientific mainstream, and probably have no point in being asked in the first place. What is being done in the interest of science inevitably runs smack into the hard fact that the “science” of reincarnation is shaky, and that science is not terribly interested in the subject in the first place—present-day science, that is.

Spook is richly researched and provides a vivid picture of just how much of a preoccupation the question of the afterlife has been for humans for many millennia. In the second chapter, “The Little Man inside the Sperm, or Possibly the Big Toe,” Roach narrates a sweeping survey of the vast array of theories on the question of the nature and origin of the human soul. Aristotle posited that the soul was to be found in semen. Herotodus, while busily dissecting cadavers in the third-century B.C., reported discovering the soul as residing in the fourth chamber of the brain. Leonardo da Vinci eventually corrected him by placing it at the top of the spine. Anton van Leeuwenhoek trumped them all: His research with early microscopes revealed the existence of tiny “animacules” with tails thrashing about in ejaculate. He went on to craft the theory of preformationism, postulating that a teeny, tiny person rested inside the sperm and, after sufficient incubation inside the host mother, would emerge as a human being with an everlasting soul.

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