material needs. "Among all of the wondrous complexities of life on earth," Frederick writes, the greatest include the values that generate technology, enabling "human life, in all of its variety, to exist and persist in the face of entropic forces."

In a similar vein, Christopher Alexander's *The Timeless Way of Building* (Oxford University Press, 1979) argues that architecture, too, is biological. Correction: *Good* architecture is biological, because it emerges from the natural conditions in which it exists, including the people who use it. This book was written before terms like *co-evolution*, *self-organization*, and *fractal* attained wide currency, but the concepts are all here. Writing of windows and gates, town squares and nation-states, Alexander says the most useful and beautiful things are made by people repeatedly applying a few simple rules to constantly varying surroundings—much as nature iterates its world. "Just like the genetic process which creates the flower," he writes, "this process must allow each person to shape his corner of the world, so that each building, each room, each doorstep, is unique according to its place in the whole—but with the built-in guarantee that the town which emerges from these independent acts will also be alive and whole."

Alexander doesn't use the living world as just some hippie-dippie metaphor for timeless beauty in the built world. "The connection between the two—between this quality in our own lives, and the same quality in our surroundings—is not just analogy, or similarity," he says. "The fact is that each one creates the other."

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With the media promising a holocaust of "emerging diseases" and an even more horrible epidemic of cloned Elvises, it's hard to know whether we'll die from out-of-control viruses or from sheer embarassment. —Ed Regis

Eric Rabkin

Ever since the opening line of the original preface to Mary Shelley's *Frankenstein, or The Modern Prometheus* (1818), science fiction has helped us explore "event[s]...not of impossible occurrence." There were two main Prometheus legends: Prometheus *porphyros*, the fire bringer, archetype for all those who use technology to put the power of the gods in the hands of men, and Prometheus *plasticator*, the life giver, shaper of humanity. Emotionally arrested Victor Frankenstein played with biology—reanimating dead flesh, creating a descendent without the messy help of a woman—and so offered one classic challenge: How can society accommodate a single individual empowered to reshape, even resurrect, our very bodies? At the verge of the third Christian millennium, such a development is far from an impossible occurrence.

But we have learned that only rarely can an individual wield such power: The road to technomancy is long and crowded. If one arrives alone, one is merely moments ahead of the crowd. How will the crowd deal with reshaping? Two provocative books treat this question: Neal Stephenson's *The Diamond Age or, A Young Lady's Illustrated Primer* (Bantam Books, 1995) and Bernard Wolfe's *Limbo* (Random House, 1952).

The Diamond Age, an enormously popular book, bursts with nanotechnology. Shrinking computers and transmitters to corpuscle size or smaller makes them injectable. They can commingle with existing brain cells, giving us the ability to think high-speed calculations, communicate telepathically, and receive prefabricated dreams. Self-replicating nanomachines repair limbs, pass like viruses during sex, and create new, tailored lineages. If the mitochondria in human cells were once free-living organisms but are now part of our "biology," will the technology that grows within us be any less biological? When we can program biology, will we still be human?

While Stephenson offers a sweeping adventure focused on a few characters in culturally distinct future "phyles," Wolfe understands that the existence of biotech is not the same as universal access to biotech. In the world of *Limbo*, a too-little-read, stunning satire of middle America, advanced prosthetics include atomic-powered minimotors in artificial joints, so that the amputee Olympics overshadows traditional competition. Soon amputation becomes voluntary...for those who can afford it. Are you a quad? Top of the heap. But whose heap? What does it mean to be a human whose very flesh is foreign to oneself and, in a sense, to everyone else?

The new biology will give us choice, and therein always is glory and danger.

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Ed Regis

At the end of the century it's hard to know whether we'll die from out-of-control viruses or from sheer embarrassment. Books, movies, and other media promise both a coming viral holocaust of AIDS, Ebola hemorrhagic fever, and miscellaneous other

"emerging diseases," and an even more horrifying epidemic of cloned Elvises, Madonnas, and Liberaces, in consequence of which the human future looks glum indeed. Two books published within the last five years present a slightly different perspective: Both are no-nonsense works firmly grounded in scientific fact, and both exude optimism steeped in the idea of progress through high technology and applied science.

Clone: The Road to Dolly and the Path Ahead (William Morrow & Co., 1998), by Gina Kolata, a *New York Times* science reporter, tells the story of the world's first cloned mammal, a plump little lamb named Dolly. Kolata presents an impressive overview of the practical benefits of cloning as well as a down-to-earth account of What It All Means, arguing that cloning is not the moral abomination it is often cracked up to be. But for me the real appeal of the story is the simple tale of how two lone researchers working in an out-of-the-way lab in rural Scotland accomplished a feat that two developmental biologists writing in the pages of *Science* as recently as 1984 had declared was "biologically impossible." It wasn't.

At War Within: The Double-Edged Sword of Immunity (Oxford University Press, 1995), by William R. Clark, a UCLA immunologist, presents an upbeat view of a decidedly unglamorous subject, the human immune system. The immune system constitutes an inner world of amazing complexity, one whose natural mechanisms can identify and neutralize most invading microorganisms, and which can be primed by vaccines to detect and destroy others. Clark argues that the system can be further improved by everything from diet, exercise, and a better mental attitude to high-tech means such as designer drugs and gene therapy—making us not the supermen of science fiction, just a lot healthier than ever before. Advances in immunology may even wipe out that omnipresent menace, AIDS. "Tomorrow, or next week, or next year, humans may produce a vaccine or a drug or a gene-therapy strategy that absolutely stops HIV dead in its tracks," Clark says. "There is precious little a virus—even one as deadly as HIV—can do about that."

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Michael Ruse

Two books stand out from many. The first is nonfiction, was published 25 years ago, and is just now being rereleased: Edward O. Wilson's magisterial *Sociobiology: The New Synthesis* (Harvard University Press, 1975). It is huge (more than 600 pages); it is comprehensive, surveying what we know of animal social behavior, from the jellyfish up to humans, from an evolutionary perspective; it is beautifully produced, with wonderful drawings, fluent prose, and clear diagrams; it is highly informative (Wilson did much of the work, especially on biogeography and animal chemical communication, himself); and it is highly controversial (Wilson argues that we humans are as much part of the animal evolutionary world as the most lowly ant or beetle).

When *Sociobiology* first appeared, it caused consternation in the ranks of social scientists, feminists, Marxists, liberals, and many others. A work that offended so many had to be saying something right. And a quarter century later we know that it was saying much that was right. Woolly-minded attempts to engineer the practices of humans beings in the name of the latest ideology are bound to fail. Little boys and little girls are not the same, and neither are big ones. There is a reason—a good biological reason—why boys are eager to slip their hands under the shirt or the pants, and there is a reason—a good biological reason—why girls are a lot less eager to let the boys have their unfettered way. Put simply, it is girls who are left carrying the baby. Wilson pointed out all of this, and much more, and did the whiners of the left ever resent it.

My second choice is fiction, and it follows on the first. *Unending Love* (Jonathan Cape, 1997), by the British Booker Prize–winning novelist Ian McEwan, is a brilliant attempt to interpret human nature in the light of the principles that Wilson expounds. McEwan tells of the pathological attraction of a disturbed young man for a successful science writer—an attraction that ends by disrupting everything, including the writer's hitherto happy common-law marriage. But McEwan is interested in much more than a story of misguided emotion, suggesting—and here he draws cleverly on the findings of sociobiology—that all of our emotions, even the most rational (as we would judge), are as illusory as those of the disturbed lover, and that in the end the whole of life is a sham, put in place by our biology to further our evolutionary ends. How he draws this conclusion and then suggests that there is more—more that biology allows—is the crux of the tale, and a very good tale it is too.

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Michael Schrage

Though not nearly as well-known or widely read as *The Selfish Gene* (1976) or *Climbing Mt. Improbable* (1998), Richard Dawkins' *The Extended Phenotype* (Oxford University Press, 1981) crackles with insights that makes you reperceive what you think you know about evolution. To dramatically oversimplify, birds aren't the products of "natural selection"; birds *and their nests* are. You can't divorce the evolution of birds from the evolution of nests. Nests, Dawkins asserts, are the "extended phenotypes" of the bird.

Are these extended phenotypes influenced by memes as well as genes? By culture as well as biology? Are human beings evolving? Or are humans and their technologies co-evolving? Dawkins does a fine job of bringing such questions to the forefront of evolutionary (re)thinking.

This kind of collision between biology's end and culture's beginning—and vice versa—can also be found in Donald Dewsbury's *Studying Animal Behavior* (University of Chicago Press, 1985), a collection of reminiscences by many of the world's leading ethologists. Most of the memoirs are as instructive as they