effort to understand what really advances the good of individuals and society"--which would conflict with "the liberal individualism of the left and the libertarianism of (some of) the right."

But bioethics "is not simply a field of philosophy," observes Alexander Morgan Capron, codirector of the Pacific Center for Health Policy and Ethics at the University of Southern California. It is "a practical discipline," he writes in *Daedalus*, which "has been driven" by highly publicized medical controversies such as the Karen Ann Quinlan case of the 1970s, by infamous medical abuses (such as the Tuskegee syphilis study), and by dramatic medical advances.

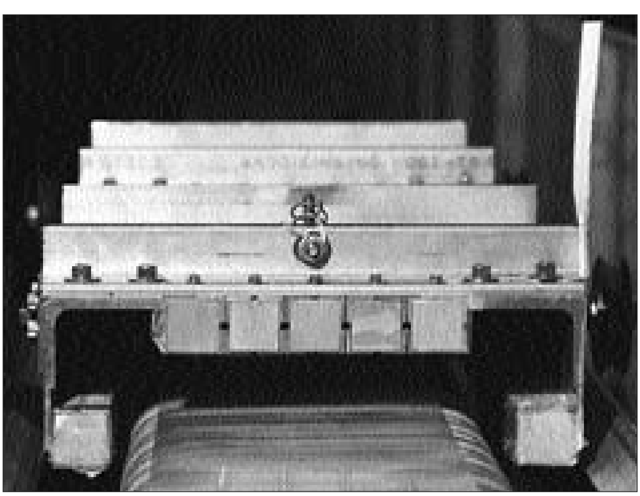
Yet at its origins, bioethics did move more in the higher realms of philosophy and theology. According to Warren Thomas Reich, a bioethicist at Georgetown University's Kennedy Institute of Ethics, writing in the *Kennedy Institute of Ethics Journal* (Mar. 1999), much of the energy infused into bioethics three decades ago came from theologians who had been involved in "the then-increasingly futile church debates" on contraception, sterilization, and abortion.

Bioethics today is determinedly secular in outlook, notes Renée C. Fox, a Fellow at the University of Pennsylvania's Center for Bioethics, writing in *Daedalus*. "Questions of a religious nature–concerning human origins, identity, and destiny, the meaning of suffering, and the mysteries of life and death," she says, generally are "screened out" as inherently insoluble problems best left to the private beliefs of individuals, or else are "translated" into acceptably secular language. In this "resolute secularism," bioethics, in Callahan's view, "is out of step with much of American culture, even though it picks up (all too much) the individualism of that culture." Bioethics, he believes, needs to expand its viewpoint and "dig more deeply into the way biomedical progress" can affect the meaning of human life.

Maglev's New Promise

"Maglev: A New Approach" by Richard F. Post, in *Scientific American* (Jan. 2000), 415 Madison Ave., New York, N.Y. 10017–1111.

For decades, it's been said that the maglev, or magnetically levitated train, would soon be arriving to whisk people off on silky-smooth rides at 300 miles per hour or more. It hasn't happened. The maglevs demonstrated in Germany and Japan have been too complicated and expensive–and not fail-safe. No full-scale commercially operating maglev system has been built. But now from Lawrence Livermore National Laboratory in California comes a new approach that Post, a senior scientist there, says may finally bring the maglev into the station.


A test cart levitates above the track, with Halbach arrays of magnetic bars visible under the cart and suspended from its sides.

In a maglev system, magnetic fields levitate the train while electricity or some other sort of power drives it forward. The Japanese system used superconducting coils to produce the magnetic fields (as two American scientists first proposed in the late 1960s). But because such coils must be kept very cool, costly cryogenic equipment is required on the train cars. "The German maglev uses conventional electromagnets rather than superconducting ones, but the system is inherently unstable because it is based on magnetic attraction rather than repulsion," Post says. In both systems, a malfunction "could lead to a sudden loss of levitation while the train is moving." Minimizing that hazard means increased "cost and complexity."

The Livermore approach uses permanent room-temperature magnets, powerful kin to the familiar refrigerator magnet and once thought inadequate to the levitational task. "On the underside of each train car," explains Post, "is a flat, rectangular array of magnetic bars called a Halbach array" (after its inventor). With the bars in that special pattern, the magnetic-field lines combine to produce a very strong field below them.

The other critical element in the "Inductrack" (as the new maglev system is called) is track "embedded with closely packed coils of insulated wire." When the train cars move forward, the magnets arrayed beneath them induce currents in the track's coils, which in turn generate an electromagnetic field that repels the Halbach arrays, lifting the train. "As long as the train is moving . . . a bit faster than walking speed," the arrays "will be levitated a few centimeters above the track's surface." Side-mounted Halbach arrays provide lateral stability. Because the levitating force increases as the magnets get closer to the coils (if the train is carrying a heavier load, for instance, or rounding a bend), this maglev system is "inherently stable," Post says.

What would happen if the drive power suddenly failed? "The train cars would remain levitated," Post says, "while slowing down to a very low speed, at which point the cars would come to rest on their auxiliary wheels."

A 1997 study concluded that an Inductrack system would be cheaper than the German maglev, and "proved that the concept is workable," Post says. And it may work for more than high-speed rail: The National Aeronautics and Space Administration thinks the Inductrack approach could prove helpful in getting rockets off the ground.

Nuclear Power Lives!

"The Need for Nuclear Power" by Richard Rhodes and Denis Beller, in *Foreign Affairs* (Jan.–Feb. 2000), 58 E. 68th St., New York, N.Y. 10021.

Nuclear power, which seems to generate more fear than electricity, is yesterday's energy source, its critics contend. On the contrary, it's very much alive and on the verge of coming into its own, argue Rhodes, author of *The Making of the Atomic Bomb* (1986), and Beller, a nuclear engineer who works at the Los Alamos National Laboratory.

Though the number of U.S. nuclear power plants has fallen from 111 in 1990 to 104, today's plants generate more electricity. Still the world's biggest producer of nuclear energy, the United States gets 20 percent of its electricity from reactors.

Nuclear power's role is even larger in other nations, such as Sweden (42 percent) and France (79 percent). "With 434 operating reactors worldwide, nuclear power is meeting the annual electrical needs of more than a billion people," Rhodes and Beller point out.

But two billion people--one-third of the world's population–currently have no access to electricity. As global energy demand grows, the authors say, so will the role of nuclear power. The British Royal Society and Royal Academy of Engineering recently predicted that worldwide energy consumption will at least double in the next half-century, posing an awesome environmental challenge: how to limit surface and air pollution and global warming.

The "worst environmental offender" (leaving aside petroleum, the leading energy source, used mainly for transportation), say Rhodes and Beller, is coal, which supplies about a fourth of the world's energy today. In the United States alone, according to recent Harvard University studies, pollutants from burning coal cause about 15,000 premature deaths a year. Besides toxic particles and nox-