The Reluctant Sectarians

"The Intellectual Appeal of the Reformation" by David C. Steinmetz, in *Theology Today* (Jan. 2001), P.O. Box 29, Princeton, N.J. 08542.

In looking back at the early Protestant Reformation, observes Steinmetz, a professor of the history of Christianity at Duke University Divinity School, it's easy to overlook an essential truth: its *Catholic* character. Martin Luther, John Calvin, and other early reformers "were not Protestants" in the way that later ones would be. "In the nature of the case, they could not be."

The Reformation began in the 16th century as "an intra-Catholic debate," writes Steinmetz. "All of the first generation of Protestant reformers and most of the second had been baptized and educated as Catholics."

Their goal was not to replace a dead or dying church with a new Christianity, says Steinmetz, but rather to achieve "a reformed Catholic Church, built upon the foundation of the prophets and apostles, purged of the medieval innovations that had distorted the gospel, subordinate to the authority of Scripture and the ancient Christian writers, and continuous with what was best in the old Church."

Most of the questions that the reformers asked and answered—e.g., Does baptism wash away original sin? Is Christ present in the Eucharist?—"were traditional questions that had been asked and answered before," Steinmetz notes. And even Catholics who rejected the movement, fearing that it would go too far, "felt the force of many Protestant criticisms . . . and attempted to accommodate some of those criticisms within the framework of medieval Catholic orthodoxy."

Eventually, however, the lines hardened, observes Steinmetz. "Faced with a stark choice between competing visions of Christianity, a large number (though never a majority) of European Catholics born between 1480 and 1510 voluntarily abandoned the Church in which they had been raised in order to ally themselves with one or another of the new reform movements." Having begun as "an argument among Catholic insiders," the Reformation continued as one between Catholics and ex-Catholics "until well past the middle of the [16th] century."

The elements in the Protestant "angle of vision" that the new converts found intellectually attractive, writes Steinmetz, included: the appeal to Christian antiquity; the intention to restate theology in the fresh language of the Bible rather than the stale one of the medieval Scholastics; the doctrine of justification by faith alone; the dedication not only to studying the Bible but to preaching the word of God; and the theoretical support for institutional reforms (such as lifting the ban on clerical marriage) to correct acknowledged abuses.

By the mid-16th century, Steinmetz says, "a permanent, self-perpetuating Protestant culture had developed. The older ex-Catholic leadership of former priests, nuns, friars, and monks was slowly replaced by a new leadership that had never attended Mass, much less said one, and by a laity that had never confessed its sins to a priest, gone on pilgrimage, invoked patron saints, made a binding vow, or purchased an indulgence." By century's end, Protestants were confirmed outsiders who had "settled into a mode of permanent opposition."

Science, Technology & Environment

Is Nanotech Getting Real?

A Survey of Recent Articles

Nanotechnology has been the next new thing for more than a few nanoseconds now, but it's still not clear how much is science and how much is science fiction. Utopian dreamers, doomsday prophets, hardheaded scientists, and now the federal government—all have been drawn to the hot new field and the promise that it could change the way virtually all products, from vaccines to computers, are designed and made.

Nanotechnology involves the manipulation of materials at the molecular or atomic level to create large structures with fundamentally new molecular organizations. The technology has vast potential in many different fields. It could enable the development of materials that are many times stronger than steel but only a fraction of the weight—and so lead to more fuel-efficient land, sea, air, and space vehicles. Nanoengineered "contrast agents" may someday be able to detect nascent cancerous tumors only a few cells in size.

Such potential benefits seem marvelous enough, but some nanotech seers imagine that the technology will do far, far more. Eric Drexler, chairman of the board at a nanotech think tank called the Foresight Institute, in Palo Alto, California, has been describing for years the incredible wonders to come. Manipulation of matter at the molecular or atomic level, he believes, is the key to boundless human prosperity. It will allow low-cost construction of virtually everything, from supercomputers to jumbo jets, ushering in a world of abundance. It also will allow humanity to conquer illness, as minute submarines roam the bloodstream, fighting disease. And nanotechnology will allow virtually all human physical defects to be corrected.

Drexler envisions tiny machines called "assemblers" doing the molecular construction work. But there's a danger, which he calls the "gray goo" problem: the possibility that assemblers could be designed to replicate themselves, multiplying like malignant cancer cells and consuming everything in their path.

That is one of the dangers that make Bill Joy, a cofounder of Sun Microsystems and a prominent computer scientist, fearful. In a *Wired* (Apr. 2000) essay that still has nanoscientist tongues wagging, Joy warned of the technology's military and terrorist uses, arguing that self-replicating nanotech devices "can be built to be selectively destructive, affecting, for example, only a certain geographical area or a group of people who are genetically distinct." Moreover, he says, the technology carries "a grave risk . . . that we might destroy the biosphere on which all life depends."

Though himself admittedly "more a computer architect than a scientist," Joy judges that "the enabling breakthrough to assemblers" is likely to occur within the next 20 years.

Joy proposes a radical solution: "relinquishment," that is, "to limit development of the technologies that are too dangerous, by limiting our pursuit of certain kinds of knowledge." He includes robotics and genetics, as well as nanotechnology.

"'Relinquishment' has a voluntary air about it," observe writers George Gilder and Richard Vigilante in the *American Spectator* (Mar. 2001), but, as Joy himself says, "'a verification regime . . . on an unprecedented scale'" would have to be applied to individuals and businesses. "Wittingly or not," they contend, "Joy has unveiled what will be the 21st century's leading rationale for anti-capitalist repression and the revival of statism . . . a program and *raison d'etre* for a new Left."

The danger from future self-replicating nanobots may be wildly overblown. Richard Smalley, a Nobel Prize-winning chemist at Rice University, in Houston, tells Robert F. Service of *Science* (Nov. 24, 2000) that, for various practical reasons, it will never be possible to build nanomachines of the sort Drexler imagines. Other nanoscience researchers, writes Service, also find "that what Joy and others fear is at best implausible and more likely plain wrong," and they have begun speaking up.

Nanotechnology today is by no means just a matter of speculation about the benign or malign future. In 1989, IBM physicists in California "dazzled the scientific world when they used a microscopic probe to painstakingly move a series of xenon atoms on a nickel surface to form a Lilliputian version of the three letters in Big Blue's logo," writes David Rotman, a senior editor at *Technology Review* (Jan.–Feb. 2001). Today, at Northwestern University, chemist Chad Mirkin, using an atomic force microscope, is turning "nano writing" (which resembles ordinary writing but has a very different purpose) into "a practical fabrication tool," which could be used, for instance, to make different configurations of biological mole-

cules that "could prove invaluable in discovering new drugs or diagnosing disease."

Inside a chamber of Mirkin's microscope, Rotman explains, "the tips of tiny probes dip into a well of organic molecules. The microscopic tips, sharpened to a point only a few atoms wide, then 'write' the words typed by Mirkin in letters tens to hundreds of nanometers wide." (A nanometer is one-billionth of a meter.) "By automating the procedure and rigging up a number of tips in parallel," Rotman continues, "Mirkin has learned how . . . to rapidly and directly create structures at the nanometer scale." This could be a way to mass-produce nanostructures, Mirkin believes.

His structures are a far cry from Drexler's nanobots, but they have the advantage of being real. Other advances in nanotechnology, notes Service, "have already led to improvements in computer data storage, solar cells, and rechargeable batteries." More are on the way. Adding to private-sector efforts, Congress last year approved the National Nanotechnology Initiative. The federal government is spending on nanoscience this year some $423 million—hardly a nanosum.

Tuskegee Redux?

"The Shame of Medical Research" by David J. Rothman, in *The New York Review of Books* (Nov. 30, 2000), 1755 Broadway, Fifth Floor, New York, N.Y. 10019–3780.

As American medical researchers have pressed the fight against AIDS, some have been conducting more of their clinical trials in Africa and Asia. So have investigators from American drug firms who want to test new treatments for various ailments without the regulatory and financial burdens of research at home. But the researchers seldom give their overseas test subjects the same high level of medical care that Americans receive. Rothman, a professor of social medicine at the Columbia College of Physicians and Surgeons, says this is wrong.

The question of whether Western standards should be applied in Africa and Asia first arose, Rothman says, after clinical trials in the United States determined in 1994 that the drug azidothymidine (AZT), though highly toxic, significantly reduced the transmission of HIV from infected pregnant mothers to their children. This treatment immediately became standard in American hospitals, but it was too expensive ($800 for a six-month course of AZT) for developing countries, where the average citizen spends less than $25 a year on health care. Researchers then sought to determine whether administering a small amount of AZT late in the pregnancy, at a cost of only $50, would be almost as effective. They conducted clinical trials involving some 17,000 pregnant women, mostly in southern Africa and Thailand. The women generally were given either the small amount of AZT or a placebo. Had the trials been conducted in the United States, Rothman notes, the women in the control group would have been given not a placebo but the already-proven six-month AZT treatment.

Critics such as Marcia Angell of the *New England Journal of Medicine* charged that in giving the women placebos, the researchers showed "a callous disregard of their welfare," in violation of the World Medical Association's code of ethics for human experimentation. But Harold Varmus and David Satcher, the then-heads, respectively, of the National Institutes of Health and the Centers for Disease Control and Prevention, which funded some of the research, defended the use of placebos. The six-month AZT treatment, they said, not only was very expensive but required frequent medical monitoring beyond the capacity of developing countries. Use of the placebos also allowed researchers to find out more quickly that the small-dose treatment was effective, thus sparing more infants. Africans and Asians on local review boards had approved the clinical trials, and the United States, proponents said, should not be dictating research ethics for developing countries.

That was far from the end of the controversy, however. "AIDS investigations in developing countries often withhold effective treatments from research subjects," says Rothman. This is not only because the treat-