Invisible Frontiers: The Race to Synthesize a Human Gene. Stephen S. Hall. *Atlantic Monthly Press, $19.95.* Every year authorities make predictions that turn out to be wrong, forecasting shortages of some commodity—oil, hospital beds, American-born field goal kickers—that correct themselves. People forget about the prediction, the experts move on to some new crisis, and nothing much comes of it.

In one instance, however, there were lasting and remarkable consequences from a mistaken forecast made by a consensus of experts in the mid-1970s: the world's diabetic population, they said, would soon face a shortage of insulin. The prediction was so dramatic it spawned an entire industry—biotechnology. Today, biotech companies employ thousands of people for work that has nothing to do with insulin—making drugs for heart attack victims and growth hormones and performing AIDS research. Early investors in these businesses have become rich and biotech has replaced computers as the glamour industry of Wall Street. This all came about because the experts were wrong about insulin.

Stephen Hall, a freelance science writer, describes in this fine book how a few mistakes, a lot of fear, and plenty of capital produced America's gene-splicing industry. He begins with the pancreases of slaughtered cows and pigs from which insulin is produced. With Americans in the 1970s consuming less red meat, the supply of carcasses appeared to be diminishing, just as an aging U.S. population was beginning to produce more insulin-dependent diabetics. The perceived shortage triggered a race to mass-produce human insulin by synthesizing a human insulin gene.

The bureaucratic mishap that started the race probably stemmed from an official who prepared projections for the Food and Drug Administration, who based his data on a mistake in an Eli Lilly training brochure that confused kilograms with pounds. "The whole thing was rubbish. There never was a shortage of pig pancreases, and there never will be," a pharmaceutical executive tells Hall. The synthesized insulin, it turned out, had neither economic nor significant medical advantages over the pig variety.

Nevertheless, the insulin scare attracted a formidable array of scientific talent. They were drawn by the chance to do what they called "Big Guy Science"—to tackle the handful of problems whose solutions held promise of a Nobel Prize. A few of them were also drawn by the opportunities it held for making them rich. The race became bicoastal. In San Francisco, a University of California scientist named

Herbert Boyer teamed up with a 28-year-old venture capitalist, Robert Swanson, who had become fascinated by DNA after reading *The Double Helix*, James Watson's account of research that led to his discovery, with Francis Crick, of the structure of DNA in 1953. Boyer and Swanson each put up $500 to start a company that they considered calling Herb-Bob before settling on Genetech. They competed against a team of scientists at the University of California, and a Harvard team led by Walter Gilbert, a former physicist who switched to molecular chemistry at the urging of Watson himself. The rivalry between the three teams soon became the dominating influence on their work. The competition led to some superhuman efforts and one case of suspected laboratory sabotage.

The press, meanwhile, fell in love with the biotech story. Hall credits the Genetech team, eventual winners of the race, with adroit use of press coverage to keep the company's anxious investors on board. After Genetech holds a press conference to announce synthesis of the insulin gene, the story is front-page news everywhere. "Hardly anyone in the press, however, bothered to ask a rather fundamental question," Hall writes. "Did Genetech's insulin actually work? Among all the reporters who described the work, only a handful of publications—among them *Nature*, *Medical World News*, and the *Los Angeles Times*—raised this important point. And the answer was: they didn't know." Still, their technological breakthroughs found ready application in the burgeoning gene-splicing industry.

Hall occasionally lapses into purple prose in his descriptions of the scientists, and his scene-switching among the three teams sometimes leave the reader bewildered. But his story of the collision of "Big Guy Science," big business, and public policy makes a worthy companion piece to *The Double Helix*. The haphazard nature of how scientific progress is made in America is summed up when Walter Gilbert wins the 1980 Nobel Prize for Chemistry. He finds out from a reporter who calls looking for a quote; the official notification from Stockholm gets lost in transit and doesn't arrive until weeks later.

—*David Graulich*

The Soviet Study of International Relations. Allen Lynch. *Cambridge University Press, $34.50.* Like Honda, Marx and Lenin made it simple: in the competition to sell their goods abroad, the capitalist nations would eventually go to war and destroy each other, and the workers of the world would rise up and unite in a glorious socialist brotherhood.

Bound by the straitjacket of dogma, Soviet analyses of international relations have not usually been taken seriously by western scholars. With the death of Stalin, it became somewhat less dangerous to life and limb for Soviet social scientists to look around and write about how the world had changed since Marx and Lenin. They couldn't, of course, repudiate the teachings of the gods upon which the communist state was founded. So they cloaked—and were allowed to cloak—their heresies under the new science of "creative Leninism."

Allen Lynch, a fellow of the Institute for East-West Security Studies, assesses the mixed success of the newer approach.

Several developments have made it necessary for Soviet leaders to accept what their social scientists have been hinting at for some time:

►In the nuclear age, the capitalist countries are not going to war with each other, and if they did, it would be hazardous to the health of any socialist onlookers; therefore, the idea of the inevitable triumph of socialism as a result of the "imperialists" self-destructing is nonsense.

►The capitalist countries are not doomed by internal contradictions and, in fact, will be around for a long time—perhaps centuries.

►In spite of Lenin's view that in a socialist order peace would prevail, the greatest threat to the security of the Soviet Union may turn out to be not the United States but its socialist neighbor—and Russia's