Patarroyo treated with his vaccine rapidly escalated into the tens of thousands—particularly as Patarroyo had, by then, almost totally divorced himself from the usual scientific process. "He said he didn't have time to come to international meetings," recalls New York's Nussenzweig. And as Patarroyo knew he could rely on funding from his friend the Colombian president, he never had to submit his work for peer review. "Nobody saw the data," says Nussenzweig. "That caused ill will on the part of the scientific community."

Those feelings seemed justified, when two groups—one from the Centers for Disease Control and Prevention in Atlanta, the other from del Valle University in Cali, Colombia—in a trial sponsored by the World Health Organization (WHO) in 1990 to repeat Patarroyo's original monkey experiments, failed to replicate his results. And when a WHO-mandated expert group visited Patarroyo's lab and concluded that none of his trials fulfilled all the conditions for randomization, double-blind, and placebo control, the vaccine was relegated to the fringes of international malaria research. Britain's Medical Research Council, for instance, has twice turned down a proposal to test the vaccine in the Gambia.

So what explains Patarroyo's sudden rehabilitation? One reason is that it's now apparent that the two WHO-sponsored studies may not have accurately repeated Patarroyo's methods. Walter Reed's Ballou says the correct formulation of the vaccine is extremely difficult to achieve. "The first time I mixed [it]," he says, "I ended up with a completely nonimmunogenic vaccine." But now that he's worked extensively with the vaccine, Ballou says he's getting results identical to Patarroyo's. The second reason is that Patarroyo has finally started attending international meetings and listening to his detractors. Indeed, in designing the trial reported in the *Lancet*, he enlisted the help of epidemiologist Pedro Alonso of Spain's National Research Council, who—although he's friendly with Patarroyo—has criticized his previous trials.

Clearly, the *Lancet* study goes out of its way to achieve scientific respectability: The 1548 volunteers were individually randomized into vaccine and placebo groups; and Alonso was on hand in the field to ensure correct double-blind procedure. "This is the first trial of Patarroyo's vaccine that seems to have been conducted rigorously," confirms epidemiologist Peter Smith of the London School of Hygiene and Tropical Medicine: "It does give evidence of protection."

One study by itself doesn't remove all of the questions surrounding Patarroyo's vaccine, however. For one thing, it's still unclear why the vaccine works. And for another, the protective efficacy rate of 39% reported in the *Lancet* paper is much lower than the 70% to 80% that Patarroyo claims to have achieved in his earlier trials. Typically unfazed, Patarroyo says that the low rate is a temporary blip, due to a pH problem with the batch of vaccine used in the latest study. But in countries where malaria is an endemic killer, even a vaccine that reduces the risk of malaria by one-third in the people to whom it's given would be a huge step forward.

Most malaria researchers are now looking to the planned Walter Reed trial in 1000 Thai children, and the WHO-sponsored international trial in 600 Tanzanians, to provide a more definitive test. But if these trials indicate that Patarroyo's vaccine does work, he's hoping that it will do more than just bring him back into the scientific mainstream. Indeed, he's looking to rehabilitate his entire country's tarnished image: "I want the world to see that Colombia is not just drug trafficking, that it has another side to it, and that side is good science."

–John Maurice

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DEFENSE CONVERSION

Swords-to-Plowshares Plan Boosts R&D

Using as his backdrop a Westinghouse factory that converted its military radars into tools of drug enforcement, President Clinton last week announced that he is releasing $1.7 billion immediately to help other companies make the same kind of swords-to-plowshares switch. The money—which will come primarily from the Pentagon's budget, though many agencies will help spend it—is just the first installment in what the White House intends to be a $20 billion "defense conversion" program over the next 4 years, according to Eugene Sperling, an economic adviser to the president. But this downpayment on defense conversion already shows how broadly the Administration is construing the term: It includes a large chunk of funds for R&D and a $48 million boost for engineering education.

About $500 million will go to commercial R&D, nonprofit collaborations, and universities.

Funding for the new technology push comes from two sources: a $1.4 billion defense appropriation earmarked by Congress for defense conversion last fall—unused by the Bush Administration—and $300 million "redirected" from other areas of the 1993 budget. The money will be used to support a hodgepodge of civilian technology projects, community aid, and retraining of technical workers. About $500 million will be spent on innovative commercial R&D projects, nonprofit collaborations, and universities, with grants awarded through a "merit review" process.

Overseeing the whole effort is a newly formed coordinating panel called the Defense Technology Conversion Council led by the Advanced Research Projects Agency (ARPA). It includes the National Science Foundation (NSF), the National Aeronautics and Space Administration, the Department of Energy, and the National Institute of Standards and Technology. Those agencies moved rapidly behind the scenes to put the package together. By the time Clinton went before the cameras to make his announcement, ARPA had already assembled a massive guide for grant-seekers, complete with a dial-in information number—(800) DualUse. According to ARPA's guidebook, this "technology reinvestment project" will make awards on a 50-50 cost basis in the following areas:

- $81.9 million for research and development on "dual use" technologies that have military and commercial potential.
- $42.1 million for carrying new ideas forward into the marketplace or to military uses.
- $90.5 million to support regional alliances aimed at commercializing technologies.
- $23.5 million for development of advanced manufacturing methods.
- $87.4 million for extension services, modeled on the agricultural extension service and aimed at helping small manufacturers upgrade their capabilities.
- $90.8 million to help companies that now depend heavily on defense funding find a niche in the nondefense market.
- $43.6 million for manufacturing engineering education at colleges and universities.
- $4.6 million to support teaching by "manufacturing experts with practical experience" at colleges and universities.
- $7.2 million for the small business innovative research program.

The interagency team that put the package together tried to make it as flexible as possible, says Joseph Bordogna, head of the engineering directorate at NSF. Universities can make proposals under many of the headings, he says. The council plans to send a team around the country to drum up interest later this spring, Bordogna says. Proposals should be submitted by July and the awards will be announced in September.

–Eliot Marshall