placebo to apply to the skin.

Army researchers are confident that niclosamide will come through the trials as a safe and effective lotion to prevent infection by cercariae. That will suit the military need to keep troops healthy. But will it help the 600 million people who live with the threat of schistosomiasis?

Gerald Webbe, professor of Applied Parasitology at the London School of Hygiene and Tropical Medicine, doubts it. "I am really skeptical about topical applications," Webbe told *Science*. "Good sanitation and improved quality of life are the real answers."

Webbe has 30 years experience of schistosomiasis in the lab and in the field, and it was he who discovered in 1975 that concentrations of niclosamide too low to kill snails nevertheless killed cercariae. He thinks that lotions and creams will not be made available because there is no market among the desperately poor people who are most exposed. And even if they were available, Webbe says local people would not use them.

One U.S. Army source agrees. He said that countries where schistosomiasis is endemic have not been clamoring for topical niclosamide. "A lot of Third World countries are not interested in protecting their people, they're interested in protecting their military. There's not much of a market."

Miller, who discovered the topical antipenetrant, is more sanguine. He thinks niclosamide could have a "tremendous impact" on endemic schistosomiasis, especially in combination with chemotherapy to treat the disease and programs to slay snails. Miller concedes that the lotion might be impractical because it has to be applied carefully and regularly. But his colleague Reynaldo Dietze, associate professor at the School of Medicine of the Federal University of Espirito Santo in Brazil, is working on a niclosamide soap that Miller thinks could be the answer. "These are very hygienic people," he says of the Brazilian farmers he has been working with. A soap containing 0.1% niclosamide would be effective and cheap. "It costs more to put the wrapper on the soap," says Miller.

If anyone ought to know what might become of the army's new product, it is the manufacturers. They would exploit it if they thought it worthwhile. Miles Laboratories, the U.S. arm of Bayer, the German company that originally developed niclosamide to kill snails, has been working with the Army on the antipenetrant. Charles Woodruff, director of product development at Miles, told *Science* that the company has no plans to make topical niclosamide more widely available. ■ Jeremy Cherfas

Superconductivity: Party Time Again

Only 6 months ago, many superconductivity scientists were worried that their party was nearly over, cut short by the presence of an uninvited guest called "flux lattice motion"—a weakness in high-temperature superconductors that appears in the presence of high magnetic fields and large electrical currents (see *Science*, 26 May, p. 914). But in the past few weeks, researchers have reported several remarkable advances that imply that this particular problem can be fixed. As a result, the mood among scientists in the field is markedly more upbeat than only a short while ago.

The most recent advance was announced by Sungho Jin of AT&T Bell Labs at the 1989 Fall Meeting of the Materials Research Society in Boston, 27 November to 2 December. Jin and co-workers produced bulk samples of the superconductor $YBa_2Cu_3O_7$ that could carry nearly ten times as much current as the best bulk materials made by standard processing techniques. At 77 K and in a 0.9 tesla magnetic field, the samples had a critical current density of 100,000 amperes per square centimeter.

High-temperature superconductors are useful because they lose all electrical resistance when cooled by liquid nitrogen, which has a boiling point of 77 K. Their usefulness has been restricted, however, by a limitation in the maximum amount of current they can carry before losing their superconductivity. The problem is not a big one for superconducting thin films, which will be used in electronics applications, because they have shown relatively high critical current densities. But the densities in bulk samples have until recently been too low for use in such applications as motors and large-field magnets.

Early this year, researchers discovered that one reason for the problem was the weakness of the so-called magnetic flux lattice in the high-temperature superconductors. When these materials are placed in a strong magnetic field, the magnetic flux flowing through the superconductor splits into individual lines which arrange themselves into an ordered array—the magnetic flux lattice. When an electric current passes through the lattice, it exerts a force that pushes on the magnetic flux lines. If the lines are not somehow pinned in place, the electric current will force them to move, which dissipates energy and ruins the perfect superconducting state of the material. The flux lattice in low-temperature superconductors can be pinned rather easily, but scientists had worried that the lattice in the high-temperature materials might be so weak they could never carry much current in a magnetic field.

The one hopeful sign was that thin films of high-temperature superconductors could carry plenty of current, which meant that they somehow avoided the problem of flux lattice pinning, but no one knew exactly how they did it. The work by the Bell Labs group may explain what is going on in thin films, Jin says, and it should point the way to forming bulk samples with usefully high critical current densities.

The Bell Labs technique depends on a clever processing trick, Jin explains. It starts with a sample of $YBa_2Cu_4O_8$, which is a slightly modified version of the $YBa_2Cu_3O_7$. Heating the sample rapidly to 920°C causes it to change into $YBa_2Cu_3O_7$. The process leaves extra copper and oxygen atoms in the sample, much as a round of musical chairs leaves one player without any place to sit, and the presence of these extra atoms scattered throughout the material creates many tiny defects in the sample. The defects apparently act as pinning centers, helping to hold the flux lattice in place and increasing the critical current density by a factor of 10.

Less than a month ago, another Bell Labs team announced it had increased the critical current density in single crystals by exposing them to neutron radiation (see *Science*, 10 November, p. 755). The same process of creating tiny defects in the superconductor appears to be at work in both the rapid heating and neutron bombardment techniques. The neutron irradiation method probably would be difficult to commercialize, however, because it adds a costly step to the manufacturing process. Jin's technique depends only on a modification of the usual fabrication method and thus is more feasible for transfer to a large-scale process.

Jin suggests that the new results may help explain why thin films of superconductors seem to have inherently high critical current densities. Work by Theo Siegrist of Bell Labs shows that when a thin film of $YBa_2Cu_3O_7$ is produced, it must first go through a $YBa_2Cu_4O_8$ phase. Thus, Jin suggests, his group's technique may be merely reproducing in bulk samples what happens naturally when thin films are made.

■ Robert Pool