ing to CXCR4 without interfering with the chemokine's ability to trigger normal signaling through this receptor. So it might be possible to design drugs targeted at CXCR4 that would not have deleterious side effects.

But so far AIDS researchers are far from ready to predict such a happy ending to the coreceptor affair. "Right now there are a lot of observations, and we can ask a lot of questions," says Littman. "But there's no story yet."

Partners in Protection

In most HIV patients the infection appears to be under control for many years before it begins progressing to AIDS. Why they eventually lose control is one of the great riddles of AIDS research. Last fall, immunologist Bruce Walker and his team at Massachusetts General Hospital in Boston, including postdoc Eric Rosenberg, reported what looked like one piece of this puzzle: Patients whose immune systems still harbor CD4 T cells, also known as T helper cells, that specifically recognize HIV proteins seem able to control their infections, while patients who have lost these anti-HIV T helpers cannot (*Science*, 21 November 1997, pp. 1400 and 1447). At the time, Walker speculated that these T helpers keep the virus in check by ganging up with another breed of T cells, called cytotoxic T lymphocytes (CTLs), which home in on and destroy virus-infected cells.

At the Park City meeting, Walker reported new research from his group that seems to support this picture—and might help lift a barricade or two from the obstacle-strewn road to an effective AIDS vaccine. In a cohort of patients who had not yet been treated with antiviral therapy, immunologist Spyros Kalams and other members of Walker's team measured the relationship between virus levels in the blood and CTL and T helper responses against HIV. They found that patients who had strong T helper responses against an HIV protein called p24, which is found in the virus's inner core, had the highest levels of anti-HIV CTLs and the lowest virus concentrations in their blood.

Taking aim. Bruce Walker says one-two punch might knock out HIV.

"[Walker] has made an important contribution in showing the importance of T helpers in maintaining CTL activity," says Jay Berzofsky, an immunologist at the National Cancer Institute in Bethesda, Maryland, who adds that the findings "are right on target in terms of showing an important direction to take in maintaining the immune system of HIV-infected people." The finding that T helpers specific to p24 appear crucial to the CTL response is especially significant, Walker told the meeting, because most efforts at vaccine development have focused on the so-called envelope proteins that make up HIV's outer coat. "If patients respond to internal proteins rather than envelope proteins, that is very important to know," agrees immunologist Rodney Phillips of the University of Oxford.

By testing the HIV-infected patients for T helper responses against synthetic peptides corresponding to small segments of p24, the group homed in on four segments that were most responsible for triggering the immune response. The researchers have now teamed up with the Boston biotech company Peptimmune to see if some of these peptides could form the basis of a vaccine to boost the T helpers and CTLs—either in people already infected with HIV or in people at risk of infection. If T helpers and CTLs can indeed be provoked to gang up on the virus, nobody is going to root for the underdog.

–**Michael Balter**

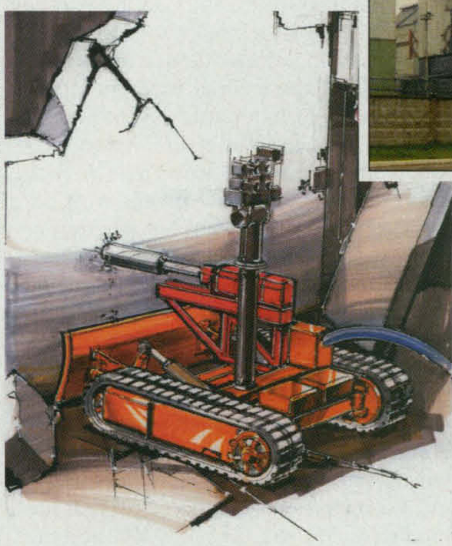
ROBOTICS

Navigating Chernobyl's Deadly Maze

In a serene forest in northeastern Ukraine is a room as forbidding as the lair of a folktale ogre. The room is in the bowels of the Chernobyl nuclear power plant—the scene of the world's worst nuclear accident when one of its reactors exploded on 26 April 1986. Filled with fiercely radioactive slag and detritus, room 305 has beaten back all comers, human and robot alike.

A new assault on 305 and other chambers in the ruined reactor is planned for this fall, when a U.S.–Ukrainian team will send in a robot fittingly named Pioneer to take samples and measure the environment. The goal of the $2.7 million effort is to map the guts of the damaged reactor building, now covered by a concrete sarcophagus that some experts fear could collapse in a moderate earthquake, sending radioactive dust into the air (*Science*, 19 April 1996, p. 352). Such a map would be invaluable to engineers attempting to stabilize the sarcophagus and prepare it for cleanup before a more sturdy covering can be built after the turn of the century.

But the foray into the sarcophagus may have other payoffs as well for the eight institutions taking part in the project. By testing the robot's ability to withstand radiation and navigate a complex environment, the mapping effort "is going to be a proving ground for many systems that we hope will have use in future planetary and asteroid exploration missions," as well as in nuclear weapons cleanup, says Pioneer project leader Maynard Holliday of Lawrence Livermore National Laboratory in California. "It's a real test and demonstration of the usefulness of robotics in situations where human activity is difficult," adds S. Venkat Shastri, robotics director at SRI International, a private research institute in Palo Alto, California, who is not involved in the project.



BRYAN LAFFITTE/RED ZONE ROBOTICS

R. STONE

Plumbing the depths. New robot will probe the radioactive guts of the Chernobyl sarcophagus *(inset)*, which covers a destroyed nuclear reactor.

After Chernobyl's number 4 reactor exploded, much of its core burned through the floor and into control rooms below. Molten uranium oxide fuel mixed with graphite rods and building materials—metal and concrete—then cooled into an amalgam called corium. Some 190 tons of this highly radioactive mineral is thought to lurk in the damaged building; its distribution has been roughly gauged by plucky Ukrainian physicists who have dashed through the dark, wet sarcophagus—even pausing for perilous seconds in room 305. But engineers need a complete, detailed look at the interior to be able to fabricate reinforcing beams and other structures that can be assembled robotically.

"The main challenge is building the robot so that it can withstand high radiation and navigate irregular terrain," says Tim Denmeade of Red Zone Robotics, a Pittsburgh-based firm collaborating on the project.* The warren of rooms beneath the reactor hall is littered with at least 10 tons of equipment-fouling dust and 2000 tons of twisted steel, concrete, and plumbing debris. But the thorniest problem is radioactivity: In room 305, radiation levels exceed 3500 rads per hour, enough to deliver a lethal dose in minutes. Most materials, lubricants, and electronics will succumb in short order when exposed to such intense radiation. Indeed, says Holliday, after the explosion "the West sent over robots that just weren't made for that environment, and they failed."

Pioneer is designed to fare better. Chernobyl engineers will steer the 450-kilogram robot, which resembles a small bulldozer, through the rubble by remote control. Along the way, Pioneer will bore into the concrete walls and floors of the reactor rooms to measure their structural integrity, using a sensor to measure resistance to the drill bit and thus calculate the material's hardness. Other sensors will generate three-dimensional (3D) profiles of temperature, humidity, neutron flux, and gamma radiation flux. And a digital 3D imaging system, using three radiation-hardened video cameras aimed by a remote computer, will create range maps using algorithms originally developed for NASA's Mars Lander.

"We're going to be at the very edge of what we can do," says Geb Thomas, an industrial engineer at the University of Iowa, Iowa City, who oversees the image processing system. If the imaging system performs well, he says, it will be used in NASA's Mars 2001 mission.

Pioneer's first test will come in August, when it runs through a mock-up of the Chernobyl reactor hall, sans radioactivity, that Red Zone is building. If that simulation goes well, Pioneer could be plumbing the heart of the sarcophagus by November.

–Joseph Alper

Joseph Alper is a free-lance writer in Louisville, Colorado.

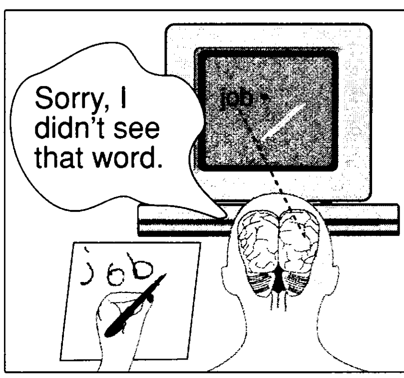
* Other participants include Silicon Graphics and NASA's Ames Research Center, both in Mountain View, California; the Jet Propulsion Laboratory in Pasadena, California; Carnegie Mellon University's Robotics Engineering Consortium in Pittsburgh; the University of Iowa, Iowa City; and the Ukrainian National Academy of Sciences.

NEUROSCIENCE

Writing, Speech Separated in Split Brain

Like unruly children in a noisy classroom who shout answers and pass notes from one side to the other, neurons in the brain are constantly chattering. When it comes time to see just who can do what, it helps to stop the cross talk and test individuals. Neuroscientists can't yet examine single neurons in living people, but on page 902 researchers describe a case where they have in effect isolated one side of the "classroom" from another—and made some surprising discoveries about how the brain organizes the components of language.

By studying an epileptic patient whose brain was surgically divided to control her seizures, Kathleen Baynes, a cognitive neuroscientist at the University of California, Davis, and her colleagues found that the centers for speech and writing, long thought to be in the same side of the brain, can reside in different hemispheres. It's hard to generalize from this single case. But the findings suggest that spoken and written language can develop separately, and may lead to a new understanding of learning disorders.



SOURCE: K. BAYNES

Reader's block. V.J.'s left brain didn't see the word, so she couldn't name it.

"The typical view is that all the components of language hang together on the same side of the brain," says Alfonso Caramazza, a cognitive neuropsychologist at Harvard University. "This shows that you can take them apart."

The patient, V.J., had suffered severe seizures. By cutting her corpus callosum, the fibrous portion of the brain that carries messages between the hemispheres, surgeons hoped to create a firebreak to prevent the seizures from spreading. The operation did decrease the frequency and severity of V.J.'s attacks. But V.J. developed an unexpected side effect: She lost the ability to write at will, although she could read and spell words aloud.

To explore what had happened, the researchers tested which skills each side of her brain could perform. For example, when they showed words and pictures to V.J.'s left hemisphere (by flashing them in her right visual field), she could read and name them aloud, but she couldn't write the corresponding words. The researchers concluded that her left hemisphere controls speech and reading, but not writing.

In contrast, when words were displayed to V.J.'s right hemisphere, she could write them—although not as well as before surgery—but she couldn't read them aloud. Nor could she write or name the word for a picture. Thus it seems that her right hemisphere controls writing, but not reading, speech, or the neural functions that allow people to find the right word for an object.

"Here's someone whose right hemisphere has all the motor information for controlling writing, but it's useless to her even for simple activities like making a grocery list," says Baynes. "She can't look at an empty butter dish and write 'butter' because her right hemisphere can't make the connection between butter itself and the word. Her left hemisphere might know that she needs butter, but it can't write that down."

It's difficult to know how far to extrapolate from one person, particularly someone with a history of seizures, cautions Baynes. Indeed, the brain organization of V.J., who is left-handed, differs markedly from that of the few other split-brain patients studied; they retained the ability to write and speak in one hemisphere and completely lost it in the other.

Still, neuroscientists are intrigued. "The fact that it's possible [to separate speech and writing] means that the brain is made up of a mosaic of autonomous parts," says Caramazza. "If it were a completely integrated system, you couldn't move writing from one hemisphere to the other—even in one person."

This insight has implications for learning disorders and language development. "To understand dyslexia, people want to figure out the connection between oral and written language skills," says Richard Ivry, a cognitive neuroscientist at the University of California, Berkeley. This work shows that "the writing system is not necessarily scaffolded on top of the phonological system." Moreover, the fact that spoken and written language are not linked supports the idea that they evolved independently, says Baynes. Indeed, in V.J.'s brain at least, the side passing notes carries on independently from the side calling out the answers.

–Evelyn Strauss

Evelyn Strauss is a free-lance writer in San Francisco.