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Illustration by Todd Detwiler for TIME

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Cure isn't a word normally used in the **context of AIDS**. For most of the **35 years since HIV**, the virus responsible for the disease, was first identified, doctors have viewed the notion of a cure as more fantasy than fact.

That's because HIV is a virus unlike any other. It disables the very immune cells that are supposed to destroy it and also sequesters itself in the body's cells, staging the ultimate deadly ambush whenever the immune defense's guard comes down, months or sometimes even years later.

Yet for the first time in the HIV epidemic that currently affects nearly 37 million people worldwide, some experts are starting to aim for a cure—cautiously—as they fashion the next generation of HIV treatments. Scientists now understand how HIV burrows itself inside cells and remains cloaked from the immune system's watchful gaze—and they have some ideas about how to expose and annihilate it. The National Institutes of Health (NIH) is funding HIV cure efforts based on this new knowledge, and advocacy groups like amfAR are also pouring resources into not just treating HIV, but also finding ways to eradicate it completely.

“Absolutely HIV can be cured,” says Rowena Johnston, vice president and director of research for amfAR. “The bazillion-dollar question is how.”

Doctors today have no trouble keeping HIV under control in people who are infected, thanks to antiretroviral (ARV) drugs, which stop the virus from replicating once it finds its way inside healthy cells. If it is not making more copies of itself, HIV cannot

spread to infect new cells. That translates into healthier, longer lives for people who are HIV-positive.

Yet as powerful as the current drug treatments are, they need to be taken daily to keep the virus suppressed, and they can't actually rid the body of infected cells. For self-preservation, some HIV does not actively pump out more copies of itself, but instead lies dormant inside certain immune cells. "The drugs are remarkably good at stopping the virus from replicating," says Dr. Robert Siliciano, professor of medicine at Johns Hopkins University School of Medicine, who first identified these sleeping virus reservoirs. "The problem is that there is also a form of HIV that is not replicating and is latent, that is not affected by the drugs and not seen by the immune system." These are the viruses that come roaring back when people stop taking their medications, or take them erratically.

But in the latest report presented this month at the Conference on Retroviruses and Opportunistic Infections in Boston, researchers revealed the strongest evidence yet that these latent viruses can be activated and eliminated, at least in animals. In a study involving a form of HIV that infects monkeys, Dr. Dan Barouch and his colleagues at Beth Israel Deaconess Medical Center and Harvard Medical School showed that a drug that stimulates the immune system and activates the dormant HIV, combined with a powerful antibody that can neutralize the HIV-infected cells, prevented HIV from surging back in five of 11 animals, six months after they stopped taking ARVs. In the monkeys whose HIV did return, the virus levels were 100 times lower than they were in animals that were not treated at all.

“I think our data raises the possibility that an intervention achieving a functional cure is possible,” says Barouch. “It shows a level of potential efficacy, at least in animals, that to the best of my knowledge hasn’t been seen before.”

The fact that nearly half of the animals did not show the typical spike in HIV that normally comes within two weeks of stopping anti-HIV drugs suggests that Barouch’s so-called “shock and kill” approach may be effectively targeting that elusive reservoir of dormant virus.

It’s a promising step toward the next frontier in HIV treatment: ridding people of the virus and, potentially, their lifelong dependence on ARV drugs.

The method hasn’t yet been tested in humans, and a cure is likely still years in the making. But there is hope. In the epidemic’s history, one person is believed to have been cured of HIV. Timothy Ray Brown, an American who is now 52, was studying in Berlin in 1995 when he tested positive for HIV. He kept his virus under control with a combination of ARVs for about 10 years, until he was hit with another devastating diagnosis: leukemia, which his doctors believed was not related to his HIV. To treat the cancer, Brown took chemotherapy and had two bone marrow transplants to replace the malignant cells in his blood and immune system. His doctor, who was aware of Brown’s HIV status, had the foresight to find a special donor for Brown who carried a mutation that would make it impossible for HIV to infect his newly transplanted cells.

Brown stopped taking ARVs when he received the bone marrow

transplants, and more than a decade later, no test has found any active HIV in Brown.

He remains the only HIV-positive person with undetectable levels of virus without using ARV medications. Other people have since seemed to mimic his case, but HIV eventually came back in each one.

Brown's case suggests that curing HIV is possible—but it may require cleaning out practically every scrap of HIV that may be hiding in the body, says Dr. Steven Deeks, professor of medicine at the University of California, San Francisco. “You probably need to get as close to zero viruses as you possibly can,” he says. “The last man standing can always pop up and get you in the end.” Even if you can't ferret out and eradicate every last remnant of HIV in every patient, researchers now believe that you could rebuild a person's immune system so it can successfully eliminate whatever virus remains.

Cancer experts are already using these types of strategies in their fight against tumors, by programming the immune system to attack malignant cells. “I am optimistic, because the parallels in what we are doing in HIV and what others are doing in cancer are so great, that we will be able to leverage what they figure out and apply it to a cure for HIV,” says Deeks.

Deeks is part of an NIH-funded collaboration of HIV experts who are investigating not just the shock-and-kill approach but also another way to neutralize the virus: by permanently locking down HIV inside the cells where it lies dormant so it can never be

reactivated again. Researchers are also studying ways to genetically splice out HIV from infected cells. And amfAR is supporting a study that so far involves 30 people with HIV who, like Brown, also developed leukemia and required bone-marrow transplants, to see if that strategy could be a reasonable option for curing the infection for some people.

No one in the field expects HIV to be vanquished in the next year or so. But they are more confident than ever that some type of cure will be part of HIV treatment in the future.

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