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News

HIV Prevention Hope: Yogurt Bugs That Make Antiviral Drugs

A research team led by Bharat Ramratnam, a Brown Medical School professor, has genetically modified bacteria found in yogurt so that the bugs produce a protein proven to block HIV infection in monkeys. The results offer hope for a microbicide that can prevent the spread of HIV, which now affects about 40 million people.

PROVIDENCE, R.I. — Researchers have come up with a novel delivery system for anti-AIDS drugs: milk-curdling bacteria used to make yogurt and cheese.

"We've found that you can engineer these bugs to secrete drugs – in this case, a viricide that disables HIV," said Bharat Ramratnam, assistant professor of medicine at Brown Medical School and attending physician at Rhode Island Hospital and The Miriam Hospital. "The hope is to use the bacteria as the basis for a microbicide which can prevent sexual transmission of HIV."

Ramratnam oversaw the bug-to-drug experiments conducted by an international team of scientists who recently published their results in the Journal of Acquired Immune Deficiency Syndromes.

Ramratnam hatched the idea a few years ago after reading about an intriguing discovery: A protein called cynovirin binds to HIV and prevents it from entering cells in the mucous membranes – a feat confirmed in both laboratory and animal studies. Ramratnam was already familiar with lactic acid bacteria, or LAB. They help make fermented foods such as yogurt and cheese by turning carbohydrates into lactic acid. LAB are also known for their "promiscuity," or the ability to accept foreign DNA, then produce proteins called for in these new genetic recipes.

So why not introduce cynovirin DNA into these bacterial protein factories?

That's what the research team tried. Using blasts of electric current, the team made tiny holes in LAB membranes and inserted circular bits of DNA that carry the recipe for cynovirin. The team succeeded: The genetically modified LAB began cranking out the HIV-blocking protein.

The hope is to use these bioengineered bacteria as the active ingredient in a microbicide – a foam, cream or suppository that can be applied to, or inserted into, the vagina or anus before sex to prevent HIV transmission. Scientists around the world are trying to develop these topical drugs as weapons in the battle against HIV/AIDS, which has killed more than 25 million people. According to the World Health Organization, this makes the HIV/AIDS epidemic one of the most destructive in recorded history.

Ramratnam, an internist who received his medical training before the advent of life-extending antiretrovirals, hopes to have a treatment to test in humans in three years. A microbicide using modified LAB will be tested in monkeys beginning this summer.

"Before we can move into human trials, we need to meet a few challenges in animal trials," he said. "We need to be sure that LAB make enough cynovirin and make sure that the cynovirin is effective. If that happens, we may have a terrific treatment on our hands."

Ramratnam also plans to genetically modify LAB to crank out proteins that disable salmonella, shigella, cholera and other pathogens that enter the body through the mucous membranes.

Ramratnam is a scientist with the Lifespan/Tufts/Brown Center for AIDS Research. Other members of the research team include Oliver Pusch with the Medical University of Austria, Daniel Boden from the Aaron Diamond AIDS Research Center, Sean Hannify with the Institute of Food Research,

Lynne Tucker from Brown Medical School, Michael Boyd from the USA Cancer Research Institute at the University of South Alabama College of Medicine, and Jerry Wells from the Swammerdam Institute for Life Sciences.

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