

Anthrax 101

A Conversation With William Dietrich

In spite of its status as an ancient disease and modern bioweapon, most people knew little about anthrax before it was spread through the U.S. mail in October. When the assault-by-letter began, however, the public suddenly needed detailed information on how the deadly bacteria wreak their havoc and how they might be stopped.

In early October, William Dietrich, an HHMI investigator at Harvard Medical School, found himself in demand among the media. By chance, just as the first attacks occurred, the journal *Current Biology* published some of Dietrich's findings on anthrax. He had identified a gene in mice that governs their susceptibility to the deadly anthrax toxin. A change in a single letter of the gene's sequence can alter the mouse's resistance to the toxin. The discovery could potentially hold true in humans as well. Here, Dietrich provides the *Bulletin* with answers to some frequently asked questions about a disease that has moved to the forefront of the country's consciousness.

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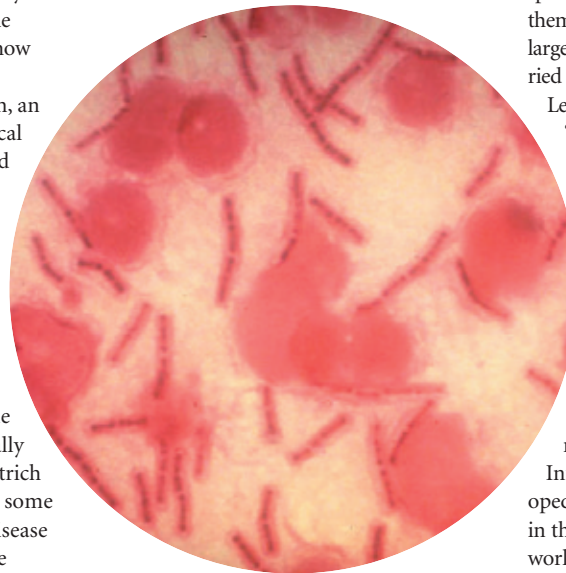
What are possible sources of the anthrax spores used in the attacks on the United States?

Dietrich: They include research laboratories, bacterial-stock clearinghouses, government-sponsored biological weapons programs in the United States and abroad and isolates obtained from soil that was contaminated from naturally occurring anthrax outbreaks.

Why is anthrax an attractive weapon to terrorists, especially considering that the infection isn't contagious?

Dietrich: It is probably easier to obtain, package and deliver than some other possible choices, such as smallpox. Anthrax is lethal if inhaled and the infection is not immediately treated. Clearly, anthrax can be a significant weapon if prepared and dis-

persed in the most effective manner. For example, in 1993, a report by the Congressional Office of Technology Assessment estimated that between 130,000 and 3 million deaths could follow the aerosolized release of 100 kg (220 lb) of anthrax spores upwind of the Washington, D.C., area. Also, the fact that the spores are resistant to temperature, humidity and other factors makes anthrax more stable and long-lasting than other potential agents.



What is the difference between the cutaneous (skin), inhalation and gastrointestinal forms of the infection?

Dietrich: It is simply the route the bacteria take to enter the body. The vast majority of infections are cutaneous. Any of the forms can be deadly, though, and the severe symptoms—blood poisoning, plummeting blood pressure, shock, bleeding and fluid in the lungs—can occur whenever a systemic infection gets established.

How do the anthrax bacteria cause such severe and life-threatening effects on the body?

Dietrich: The bacteria target macrophages, cells of the immune system that seek out and engulf foreign substances. The bug produces a toxin that enters the macrophages and disrupts the function of key proteins. This poisoning causes the cells to burst, which releas-

es biological molecules that send the body into shock.

What makes anthrax “weapons-grade”?

Dietrich: I do not have direct experience in “weaponizing” anthrax. From my reading of secondary sources, part of it is related to isolating spore preparations that are of such small diameter they can float for long distances and effectively penetrate the respiratory tract. It also seems that there are ways of treating the spores to remove the electrostatic charge on them, making them easier to disperse over a large area. This treatment reportedly was carried out on the anthrax sent to Senate Majority Leader Tom Daschle's office. The term “weapons-grade” is also perhaps related to forms of the bacillus that are specifically created to be antibiotic-resistant.

Excluding a deliberate attack, what are the average person's chances of contracting anthrax?

Dietrich: If you live in the United States, your chances are virtually nil. Until the October attacks, there hadn't been a case of inhalation anthrax reported in this country since 1978. Infections are more common in less developed parts of the world. I have seen numbers in the tens of thousands of cases annually worldwide, though these estimates seem excessive to me.

Should everyone buy antibiotics and keep them on hand in case of an anthrax outbreak?

Dietrich: In most cases, it would be a waste of money. You are unlikely to know whether you've been exposed to anthrax unless the government and public health officials are involved, and in the unlikely event that you were exposed, you'd be able to receive prophylactic antibiotic treatment right away.

Is there a vaccine that could protect the entire population?

Dietrich: No. The existing anthrax vaccine stock is sufficient only to protect members of the armed forces. Even if there was an ample supply, it can have some serious side effects and must be administered in a series of injections over months and years.

—RICHARD SALTUS