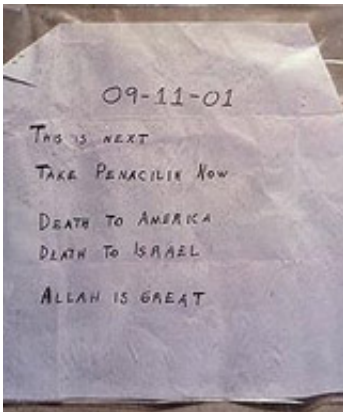


Now, the story can be told -- how scientists helped ID 'Amerithrax'

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Anthrax Letter, 2001

(PhysOrg.com) -- It took nearly a decade before University of Maryland researchers were allowed to talk about their work identifying the anthrax strain used in the 2001 deadly letter attacks. But now, they and the other key members of the high-powered science team have published the first account of the pioneering work, which launched the new field of "microbial forensics" and gave bioterrorism investigators a way to "fingerprint" bacteria.

The current online Early Edition of the [Proceedings of National Academy of Sciences](#) (*PNAS*) details the multi-institutional research that the FBI ultimately used to track anthrax-laden letters back to test tube number RMR-1029 at a lab in Fort Detrick, Maryland. University of

Maryland bioinformatics experts co-authored the article and conducted the [computational analysis](#) that detected four [genetic mutations](#) that together comprised a unique signature of a particular colony of anthrax bacteria. The FBI subsequently determined this colony was found only in that Ft. Detrick test tube.

The Maryland researchers have since developed their work into a genetic 'fingerprinting' tool that is available online to law enforcement seeking to track down other microbial suspects.

"We found unique bio-markers to help investigators track down the source of the anthrax," said Steven Salzberg, director of the University of Maryland Center for Bioinformatics and Computational Biology (CBCB). "At first the tiny mutations were elusive. We thought we'd pieced together the 'jigsaw puzzle' of data very neatly, until we ended up with a few oddball bits left over. When we looked more closely, we found an extra copy of a critical gene."

"Fortunately, [anthrax bacteria](#) mutate relatively slowly, so the material in this colony developed these small distinctive mutations that resulted in physically distinct characteristics," explained Mihai Pop, Salzberg's CBCB colleague and article co-author. "If you isolate a colony of bacteria in a test tube, they'll slowly accumulate [random mutations](#) that make them distinct from any other samples of the same type of bacteria."

"Our colleagues at the University of Maryland School of Medicine's Institute for Genome Sciences sequenced the DNA of the bacterial samples provided by the FBI. Then, using computational analysis, we identified four tiny changes in the DNA structure that the FBI could use as a fingerprint in their investigation," Salzberg explained.

"NOTHING LIKE CSI"

Working on a sensitive, high-profile project involving national security turned out to be nothing like Salzberg expected. It was 2001, several letters with anthrax powder had been sent to Capitol Hill and various media outlets. Five people had died and 19 more were sickened. The FBI asked Salzberg, Pop and their colleagues to analyze samples of the powdered anthrax in the letters.

"We mainly got blind samples – most of the time we had no idea of the material's origin," Salzberg said. "Our job was to comb through the DNA sequence data and puzzle out the genetic structure. When we'd done it, we handed our report to the FBI, and they simply said, 'Thank you. You've been a great help.' We heard almost nothing for five years, which was frustrating at times. We wanted to ask, 'How did this help?'"

NRC – FBI

Subsequently, the FBI concluded that only anthrax samples from test tube RMR-1029 at Ft. Detrick had the identical genetic structure with the anthrax powder sent through the U.S. mail. These samples shared the four quirks identified by the University of Maryland computational biology team.

Last month, a team of top scientists assembled by the National Research Council reviewed the FBI's investigation – at the FBI's request. [The report](#) found no fault with the science. However, it did challenge the FBI's interpretation and use of it, concluding, "The scientific link between the letter material and flask RMR-1029 is not as conclusive as stated in the Department of Justice Investigative summary."

MICROBIAL FORENSICS: A NEW TOOL FOR LAW ENFORCEMENT

The researchers' 2001 work, in effect, launched a new field of microbial forensics, the study reports.

"Before the anthrax letter attacks of 2001, the developing field of microbial forensics relied on microbial genotyping schemes based on a small portion of a genome sequence. Amerithrax, the investigation into the [anthrax](#) letter attacks, applied high-resolution whole-genome sequencing and comparative genomics....This study demonstrates the forensic value of systematic microbiological analysis combined with whole-genome sequencing and comparative genomics," according to the PNAS article.

"Ten years ago, the team broke new ground, and in the intervening years we've developed this into a standard tool that law enforcement and anti-terror agencies can use on their own," Salzberg explained. "We recently finished a project for the U.S. Department of Homeland Security, producing an online, open-source tool that agencies can download and use to fingerprint microbes used in attacks."

More information: www.pnas.org/content/early/2011/03/08/1016657108.abstract

Provided by University of Maryland

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