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For Information: Don Kennedy, 410-436-7118 6 April 2011

ECBC Announces Publication of Microbial Forensics Study on Historical Biowarfare Simulant

Aberdeen Proving Ground, Md. — In an effort to develop countermeasures to emerging biological warfare threats, scientists working at the U.S. Army Edgewood Chemical Biological Center's (ECBC) genomics sequencing center revealed techniques used to characterize a non-pathogenic surrogate for anthrax in a microbial forensics study, entitled "Genomic Signatures of Strain Selection and Enhancement in Bacillus atrophaeus var. globigii, a Historical Biowarfare Simulant."

ECBC scientists used a ground-breaking mix of genomics and microbiology to track back the genetic lineage of Bacillus atrophaeus var. globigii (BG) strains, similar to the measures described in the recently published report from the National Academy of Sciences on the science behind the ensuing Amerithrax investigation, one of the largest and most complex in the history of law enforcement.

Henry Gibbons, Ph.D., research microbiologist at ECBC, led the breakthrough research efforts, funded through the Transformational Medical Technologies (TMT) program of the Defense Threat and Reduction Agency (DTRA), identifying the genetic fingerprint of BG and disclosing the evidence for its development as anthrax surrogate in the 1940s. The goal of the TMT program is to provide a rapid response capability to identify emerging, enhanced and engineered pathogens and to quickly deliver new countermeasures to the warfighter.

"This study sets a framework for interpreting and assigning meaning to very large data sets and also to the function and effects of mutations that initially seem uncertain," Gibbons said. "We are now a step closer to rapidly identifying an organism as enhanced, engineered or as a particularly threatening natural isolate. And, the knowledge that we have generated can be used to develop future detection technologies and assays."

This research study started with Gibbons and the Center's genomics laboratory staff sequencing a strain of BG obtained from Dugway Proving Ground, when ECBC first opened its genomics sequencing center in 2008. They then compared the Dugway strain to similar strain samples that had been stored in the archives of the University of Wisconsin's Bacteriology Department for the past six decades. Some of the samples dating back to the 1940s were originally developed at Camp Detrick, today known as Fort Detrick.

During the analysis process of archival and present-day strains with simulant strains, the use of

whole-genome sequencing and comparative genomics revealed genomic and phenotypic signatures of strain adaption and deliberate selection of a trait that was desirable in a simulant organism — the ability to produce pure spores on a large scale.

In addition to ECBC's genetic research, an unclassified paper published in the Journal of Bacteriology at Camp Detrick in 1946 indicated that research on sporulation efficiency was conducted at the time.

"As the first laboratory to sequence BG, our scientific approach combined the investigation of classical bacteriological markers, metabolic profiling and whole-genome shotgun sequencing," Gibbons said. "These methods essentially allowed us to generate a unique fingerprint for all the isolates and ultimately obtain clear evidence for Fort Detrick's intent to optimize the BG strains for use as an anthrax surrogate between 1942 and 1946."

The measures and results outlined in this microbial investigation add a crucial component to the genomics research conducted across the chemical biological (CB) community, addressing techniques that help rapidly identify and address emerging pathogens.

"I am extremely proud of the relevant work ECBC's employees contribute to the greater CB community every day," said ECBC Technical Director Joseph Wienand. "The research detailed in this report not only advances technology in microbial forensics, but more importantly helps protect the warfighter and homeland against potential emerging biological threats."

The work, led by Gibbons, involved an interdisciplinary team of microbiologists, sequencing experts, bioinformaticists and statisticians. Scientists that played an integral role in its completion include ECBC Biologist Stacey Broomall, Research Microbiologist Lauren McNew and Research Biologist Nicole Rosenzweig, Ph.D. as well as Research Associate Carol Chapman from the Naval Medical Research Center and Faculty Associate John Lindquist from the University of Wisconsin's Bacteriology Department.

For more information about ECBC, visit http://www.ecbc.army.mil/.

ECBC is the Army's principal research and development center for chemical and biological defense technology, engineering and field operations. ECBC has achieved major technological advances for the warfighter and for our national defense, with a long and distinguished history of providing the Armed Forces with quality systems and outstanding customer service. Located at the Edgewood Area of Aberdeen Proving Ground, Md., ECBC is a U.S. Army Research, Development and Engineering Command laboratory. For more information about the Edgewood Chemical Biological Center, please visit our web site at http://www.ecbc.army.mil/ or call (410) 436-7718.

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