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Bacterial Forensics: Revolutionizing Biochemical Analysis

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By Caitlin Cain

Eva Childrey is a junior forensic science and chemistry double major working in Dr. Ehrhardt's research laboratory at VCU. The main goal of the research conducted in this laboratory is to explore the lipid profiles of different bacterial species.

Dr. Ehrhardt completed a post-doctoral position with the Federal Bureau of Investigation on bacterial forensics, which became the basis of Childrey's research. During her sophomore year, she pursued an independent study with the Ehrhardt laboratory focusing on the quantitation of fatty acids on the surface of Bacillus cereus. The purpose of the study was to be able to identify both a strain of this species and the growth medium used through a gas chromatography data library search with the given lipid signals.

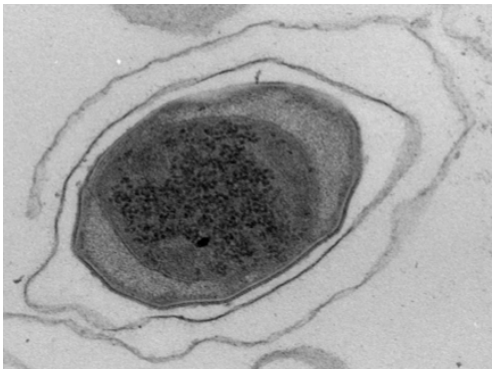

Figure 1: Picture of Bacillus cereus 14579 spore. The exosporium is the gelatinous material around the outside of the cell.

Figure 2: Real time sampling using DART-MS.

After completing her independent study, Childrey was presented with a 2015 Undergraduate Research Opportunities Program (UROP) fellowship. With the fellowship, she expanded on her independent study by focusing on the analysis of fatty acids found on the exosporium of the bacterial cell. Childrey stated that forensic analysis of the bacterial exosporium allows for the lipid profiles to be analyzed without destructing the cell sample.

Now, in her junior year, Childrey continues to complete the goals her UROP fellowship set out to solve. She is now looking at refining the steps needed to wash the exosporium of the bacterial spore and analyzing the wash for any characteristic residue of fatty acids. Additionally, she is using Direct Analysis in Real Time Mass Spectrometry (DART-MS) to analyze lipid signals. Collectively, Childrey said that these goals will help forensic scientists analyze trace amounts of bacterial cells and can be applied to other types of bacterial species.

She became interested in pursuing undergraduate research opportunities due to the influence of an older brother. Before starting her research, Childrey wanted a way to understand how real-world laboratories work and learn how to make connections. "Getting into research early was the right place for me," said Childrey. She found that her experience in Dr. Ehrhardt's laboratory gave her a real understanding of the complex concepts she learned in her classes. When beginning her research, Childrey thought

the research would focus solely on forensic science, but she now appreciates how the building blocks of biology and chemistry have influenced her project.

After graduation, she hopes to continue research in different bacterial species and other pathogens. Ultimately, she plans to earn a doctorate in biochemistry because she enjoys the intersection between these fields. Childrey stated, "I really love the work I do with the bacteria."

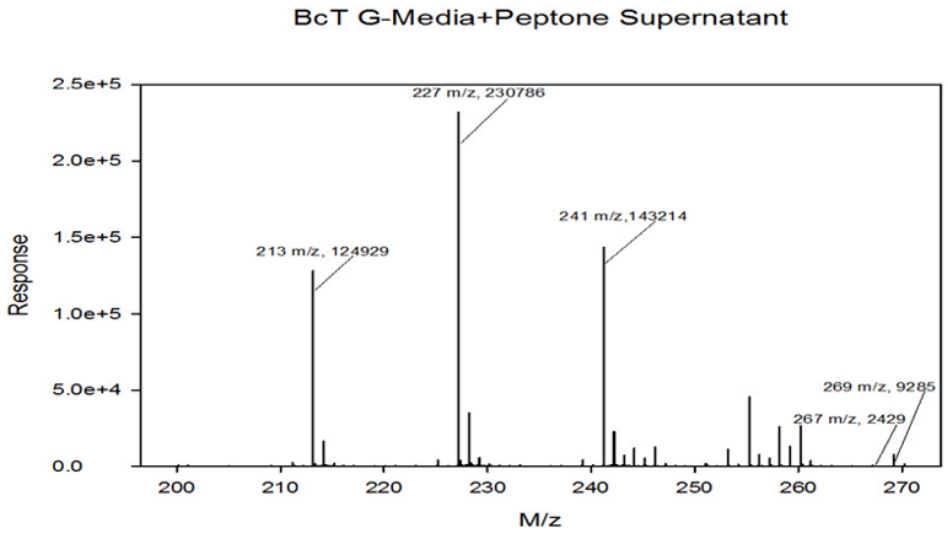

Figure 3: DART-MS spectra of the exosporium wash with fatty acid biomarkers labeled.