Bdellovibrio bacteriovorus:
A Novel Source For Antimicrobials
Introduction
The alarming rate in which bacterial human pathogens become resistant to most, if not all, antimi-
crobials that are currently at our disposal is of great concern (Davis and Davis, 2010, anon 2012).
The latest incident to reach the headlines was the ongoing multi-drug-resistant epidemic within the NIH hospital in Bethesda, Md which so far was linked to the death of seven people and is causing alarm in the community (Szalavitz, 2012). The pathogen responsible for this latest outbreak, *Klebsiella pneumoniae*, is one of several common bacterial pathogens causing Hospital acquired infections. These pathogens include *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, methicillin-resistant *Staphylococcus aureus* and other emerging multi drug resistant pathogens. Due to naturally occurring phenomena like horizontal gene transfer (the acquisition of genetic traits from other bacteria through exchange of genetic elements), extended resistance to antibiotics in biofilm, the ability of these pathogens to survive and grow outside a human host, and the impaired performance of the immune system in many of the patients found in hospital settings, these infections can become life threatening and extremely hard to treat.

It seems the era of antibiotics as a magic-bullet against bacteria is approaching its end. We might be facing times our grandparents and their ancestors new only too well - when any small cut had the potential to evolve into a life-threatening situation, when an ear infection could have resulted in deafness and a sore throat.

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The gloom future, where society will no longer be able to protect its most susceptible members (babies, young children, the elderly, and the immune-compromised) against common bacterial pathogens seems unavoidable (Carlet et al. 2012). This doomsday scenario, where we will find ourselves spending much more time and resources trying to keep those we care about safe from bacterial pathogens, is not a bad dream anymore; however it is not a given either. We can and should act, if we would shift our attention and devote the needed resources to support basic and translational research aimed at identifying novel methods to fight back against these pathogens our ingenuity and talent will prevail and keep us one step ahead in this century-long arms race.

Here, at WRAIR, the Wound infection Department (part of the Bacterial and Rickettsial Disease branch) led by MAJ Tom Palys is doing exactly that. The department members examine ways to enhance the effectiveness of old antibiotics, investigate how micronutrients, like iron, affect infection, revisit pre-antibiotic therapeutics such as maggot therapy and lastly, looking into what nature has to offer, in the form of bacterial predators that feed on these pathogens – following the proverb “the enemy of my enemy is my friend”.

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An alternative approach is harnessing the tools of the predator *B. bacteriovorus* evolved during its evolution to identify and destroy its prey as weapons in our endeavor to overcome infections caused by Gram (-) bacteria. By mining the genome, proteome, and small molecules of this amazing predator we strive to identify the unique tools it uses during its lifecycle to identify and kill its prey.

Taken together, these complementing approaches will result in the development of novel procedures and therapeutics to help us overcome common and sometime lethal infections in the wounded warrior and will contribute to society as a whole.

*Bdellovibrio bacteriovorus* and *Bdellovibrio* like organisms are amazing microorganisms. First described in the 60s, they are the Cheetahs of the bacterial world (*Shilo & Bruff, 1965*). These small, Gram (-), obligate predatory bacteria, will swim and attach to the outer membrane of other Gram (-) bacteria like E. coli, A. baumannii, and K. pneumoniae. After inserting themselves in between the two membranes (into the periplasmic space) of their prey they will start replicating and literally suck the life out of the prey cell until they are ready to burst and start a new cycle of attack.

The concept of using whole *B. bacteriovorus* live cells to assist in our fight against pathogens is gaining acceptance in the scientific community (*Dwidar et al. 2012*). The clear advantages – of a broad host range – implying effective reduction in the numbers of many Gram (-) pathogens, ability to attack cells regardless of their growth state (stationary or growing), and the ability to swim and find their prey even within biofilms makes it worthwhile to try and overcome the obstacles – slow growth rate, fastidious growth conditions, and regulatory hurdles.
About Clinical Research Management, Inc.

Clinical Research Management (ClinicalRM) is not only involved in the testing of new antibiotics in Phase I, II, III studies, monitoring protocol development, site selection, and assistance with FDA approvals, but is also involved in responding to the challenges of antimicrobial resistance. Our epidemiologists track resistance patterns around the globe and they evaluate how the observed resistance appears, where it emanates from, and how we can best contain the spread of the new resistance factors.

Our scientists work with the Government and academia to develop new responses to the ever-growing threat of multiple-resistant superbugs. They use in silico techniques, as well as information from genomics, to determine sites on, or in, these organisms that are most likely to be vulnerable to engineered antimicrobials. ClinicalRM is committed to developing new responses to disease and the challenges presented by these super-bugs. If you feel ClinicalRM can add value to your research efforts, we are interested in speaking with you. Call toll free at (800) 431-9640 or visit www.clinicalrm.com

Bibliography


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Dr. Gancz is a Research Scientist at Clinical Research Management, Inc. (ClinicalRM) and is a Microbiologist & a Biotechnology and Food Engineer. Dr. Gancz earned his Ph.D. in Biotechnology at The Technion, Israel Institute of Technology, Haifa, Israel, and spent 6 years as a postdoctoral fellow at the Microbiology & Immunology Department at Uniformed Services University of the Health Sciences (USUHS) in Bethesda, Md. He is currently conducting research at the Wound Infection Department at Walter Reed Army Institute of Research (WRAIR) in Silver Spring, Md. He has 15 years experience working in Microbiological and Biochemical Research.