Probing the Past to Predict the Future: Shigella flexneri from World War I

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Abstract:

Infectious diseases are not a new phenomena. Bacteria have evolved over millions of years and have adapted to life with humans. Understanding the history of bacteria, and monitoring how they have evolved have proved to be an effective tool in controlling these pathogens.

Main Article:

Private Ernest Cable of the 2nd Battalion, East Surrey Regiment was a young soldier fighting in Wimereux, France, during the First World War. He arrived at the No 14 Stationary Hospital with bloody diarrhea and bad abdominal cramping in March 1915, and later died of dysentery. His story was a common one in the water-logged trenches, where soldiers survived enemy fire but died of infections brought on by life without sanitation. In Private Cable's case, the infection was caused by a bacterium called *Shigella flexneri* that is typically spread via fecal contamination of food or water. Private Cable's strain of *S. flexneri* was collected by a microbiologist in the field and later became the first bacterial isolate deposited in the United Kingdom's repository of bacterial strains (the National Collection of Type Cultures). It is now the oldest living pathogen we have in any such collection, and bears the strain name 'Cable'.

Infection control has come a long way in the 100 years since Private Cable and hundreds of thousands of other soldiers succumbed to bacterial dysentery in the trenches. However, *Shigella* still causes at least 80 million cases of bloody diarrhea a year (resulting in about 700,000 deaths annually), mostly of children in the developing world[1]. The vast majority of those infected (>99%) live without adequate health care, and for that reason the World Health Organization has designated *Shigella* as a prime target for vaccine development[1].

Vaccines are most effective against pathogens that evolve slowly. Private Cable's historical strain of *Shigella* offered scientists an exciting opportunity to compare a 100 year-old strain against modern-day strains of *Shigella*. Towards that end, the 'Cable' strain was revived and its genome was sequenced in 2014. The genome analysis showed that *Shigella* was already well adapted to life as a human pathogen by World War 1, and has evolved slowly since. Interestingly, despite its isolation before the discovery of antibiotics, the 'Cable' strain was found to be resistant to antibiotics erythromycin and penicillin. Antibiotics are ancient compounds naturally produced and found in the environment, and *Shigella* may have picked up antibiotic resistance from other environmental bacteria. Modern-day *Shigella* is also resistant to first-line drugs like ampicillin and trimethoprim-sulfamethoxazole[2], making the development of a vaccine an even greater priority.

Although Private Cable's strain of *Shigella* is the oldest living strain of bacteria on record, scientists have been able to retrieve genetic information from bacteria that lived as long as 30,000 years ago[3]. Probing the past may help scientists predict the course of future evolution of pathogens and antibiotic resistance.

References:

[1] http://www.who.int/maternal_child_adolescent/documents/9241592330/en/

[2] http://www.cdc.gov/shigella/resources.html

[3] D'Costa VM *et al.* Antibiotic resistance is ancient. 2011. Nature **477**: 457-61.