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Microbes and Anthropology

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By Erin Koch

Microbes are everywhere; viruses, bacteria, and fungi are among the most abundant and diverse forms of life on earth. Anyone who has ever contemplated purchasing—or experienced bewilderment at the existence of antibacterial ballpoint pens, bedding, athletic clothing, soaps or similar products can attest to the prominence of bacteria in everyday cultural consciousness in the U.S. I for one am building a modest collection of plush microbes courtesy of GiantMicrobes. As an anthropologist who studies infectious disease at the intersections of medical anthropology and science and technology studies, I often wonder why cultural anthropologists do not embrace microbes more in our studies.

To be fair, there is long-standing and impressive scholarship among anthropologists concerned with infectious disease. There seems to be increasing attention to pathogen-borne forms of affliction, as well as to the ways in which benevolent microorganisms sustain humans, animals and ecosystems, some of which attends to microbial matters. Interesting examples include those by Elizabeth Dunn (2008), Stefan Helmreich (2008), Shirley Lindenbaum (2001), Kathryn M. Orzech and Mark Nichter (2008) and Heather Paxson (2008). (There are likely others across sub-disciplines of anthropology, but my goal here is not to provide a literature review). All of these authors attend to particular roles played by specific pathogens in domains such as food politics, infectious disease and marine ecologies and the implications thereof for human-microbe configurations of culture, politics and biology. However, even among this small group of studies, only those by Helmreich, and Orzech and Nichter offer an anthropological perspective that consider things from a microbial point of view.

Mycobacterium tuberculosis (Mtb), the causative agent of pulmonary tuberculosis in humans and a “successful pathogen,” offers a particularly interesting case for investigating complex dynamics of culture, biology and politics, as I investigate in an unpublished article manuscript. Here, I address a few key points:

1. Mtb is everywhere. According to the WHO, approximately 1.6 million adult deaths in 2006 resulted from tuberculosis. One out of every three individuals worldwide (approximately 2 billion people) is infected with Mtb.

Approximately one individual is newly infected with Mtb every second and one individual dies from tuberculosis every 20 seconds. Finally, approximately 5% of people who are newly infected with Mtb are infected with drug-resistant strains.

2. Mtb bears impressive capacities for long-term survival in both latent and active forms, reactivation, and evolution in response to attack by antibiotics. However, these attributes are not well understood in microbiological and pharmacological studies of Mtb. It is important for social scientists that study infectious disease to learn about the biochemical attributes and activities of the microbes we study as part of our fieldwork.

3. Though not the subject of this post, it is worth noting that Mtb's biochemical attributes also shape and are shaped by different ways of isolating bacteria and manipulating them in laboratories. Clinical and laboratory tests for detecting and diagnosing tuberculosis, and for determining antibiotic resistance, are shamefully outdated. Although faster methods exist than those used in most resource-poor settings where tuberculosis proliferates, they are difficult to support at a technical level; their meanings, benefits and burdens emerge in local political, economic and cultural contexts.

Here I highlight Mtb's ability to lay dormant and undetected in human lung tissues, and then reactivate (usually under condition of immunosuppression). These characteristics are among the most impressive and scary, especially because current WHO-mandated global standards for TB control prioritize active cases over latent ones. This is solid public health for a variety of reasons. The rise in forms of tuberculosis known as XDR-TB that are virtually untreatable certainly present a strong case for prioritizing active cases over latent ones. And it is noteworthy that such cases gain increasing attention in mass media, as the stories of Andrew Speaker, TB isolation facilities where incarceration is operationalized as a public health measure, and recent reports about XDR in Armenia all attest. However, because approximately 9 million new cases of tuberculosis were reported by the WHO in 2006, I still find it shocking that diagnostic, preventative and treatment systems focus primarily on people who are actively sick with Mtb.

How does Mtb establish latency and escape detection? A complex wall of lipids that help to protect it from detection by the immune system surrounds *Mycobacterium tuberculosis*. This waxy cell wall also forms a biochemical matrix that renders the majority of available antibiotics ineffective. Structurally and chemically Mtb has the capacity to exploit a host's immune system to establish latency. When Mtb invades the lungs, the human immune system responds by sending giant cells called

macrophages to engulf bacteria and sequester them where, presumably, bacteria would be destroyed. Following this, cells fuse to form masses of (usually chronically) inflamed tissue called granulomas. In the majority of those infected with Mtb, the formation of granulomas prevents active infection from developing. However, Mtb is capable of interfering with abilities of macrophages to eliminate the microorganism. In other words, the biochemical properties of Mtb allow the bacteria to use the human immune response in its favor to establish latency, settle in a colony and lay dormant for years. Such microbes (especially those that persevere despite the appropriate use of antibiotics) are often referred to as "persistors." These attributes also call into question the rigidity of a latent—active dichotomy, and detection mechanisms that favor active cases.

There is a desperate need for novel diagnostic, prophylactic and treatment strategies. Many impressive strides are being made with insights into host-pathogen interactions, namely different stages of infection and metabolic (in)activity of Mtb. Nonetheless, aside from a few "me too" antibiotics that are knock-offs of existing drugs, no new anti-tuberculosis medicines have been marketed since rifampin in the mid-1960s. Tuberculosis is a non-profit disease that does not capture the attention of drug companies because the majority of those infected are poor. The lengthy growth cycle of Mtb also makes it a hassle to work with. Because successful treatment is usually only accomplished with a combination of drugs, it is difficult to utilize bench science to select ideal targets that will not be undermined by drug-to-drug antagonism. Thus, it is difficult to run clinical trials that demonstrate the efficacy of a single new medicine. Trials are expensive and with TB, lengthy; after a course of treatment with a trial drug, researchers must wait 18 months to know whether the patient will relapse. Microbial growth and R&D stagnancy are co-produced.

Taken together, these dynamics underscore the fuzzy nature of cultural lines that are taken-for-granted between microbial and social realms, and call into question the ways in which social scientists confront biology that run the risk of producing both biological and cultural reductionisms. Clearly microbes are part of the social fabric, rather than external agents that infect sociality.

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