Letters

Have They Proven that Mycobacteria Are Present “in the Mist?”

In the December 2009 issue of Microbe (page 545), Marcia Stone discusses the recent paper by Feazel et al. (“Opportunistic pathogens enriched in showerhead biofilms,” Proc. Natl. Acad. Sci. USA 106: 16393–16399, 2009) concerning the suggested presence of Mycobacterium avium in waters derived from showerheads, in an article entitled “Mycobacteria in the mist.” It is noted in this article that these organisms are “strongly enriched” in waters from the showerhead environment, that “microbial communities” were being studied, and that the paper authors “relied on metagenomics, using amplified ribosomal RNA (rRNA) genes, to identify organisms.” A review of the original PNAS paper suggests that none of these conclusions can be supported. Bulk extraction approaches were used to recover nucleic acids from the natural microbial assemblages used in these analyses. No evidence has been provided that would relate the recovered sequences to microbes, more specifically to in situ active microbes, the “microbial community,” or to make it possible to “identify organisms.”

What is the central problem? Bulk-extracted nucleic acids have been used, where one has no idea of the source(s) of nucleic acids that are being studied. To make the assumption that a bulk extraction-recovered 16s rRNA sequence → bacterium → in situ active member of a “microbial community” without establishing a direct linkage is indefensible. Although fluorescence and scanning electron microscopic images of showerhead biofilms are shown in the PNAS paper and a file photomicrograph of Mycobacterium is presented in this Microbe article, no information is provided that links these depicted bacteria (for which no evidence of activity is given) with any extracted molecular sequence.

In my view, the notion, available in the literature from 1985–1986, that a sequence extracted from a natural microbial assemblage by bulk extraction-based procedures represents a microbe, and more specifically an in situ active microbe, a member of a microbial community, without establishing a link between the molecular sequence and an actual in situ active microbe, as also assumed in this article, has done irreparable damage to the entire field of biology. The most damaging aspect of this notion is the furtherance of the world view that the source of information (in this case, bulk extracted-derived molecular sequences) can be assumed, without providing documentation concerning the actual source of the information—pure intellectual legerdemain. My final thought? It is critical to review the methods that are used in a scientific paper to be sure that they support the assumptions that are being made. In my view, the paper by Feazel et al., discussed in this Microbe article does not pass this test.

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Quorum Sensing Is Not a Mismomer

The paper by Brinker, Gresham, and collaborators (Nature Chem. Biol. 6:41–45, 2010), and the commentary in the March 2010 issue of Microbe (p. 99–100) by science writer Carol Potera, are mistaken in asserting that the term quorum sensing is a misnomer. When first reported by Nealson et al. in 1970 (J. Bacteriol. 104: 313–322) it was called autoinduction, and one of the first experiments was to show that it could be attributed to a substance (termed autoinducer) released into the medium by the cells themselves and did not require a dense population of cells. With the chemical identification and synthesis of autoinducer (A. Eberhard et al., Biochemistry 20:2444–2449, 1981), R. A. Rosson and K. H. Nealson (Arch. Microbiol. 129:299–304, 1981) showed that induction could be caused by added autoinducer at densities as low as 10^5 cells/ml⁻¹ and that it is invariant with cell density over a 1,000-fold range. These key papers were not cited by Brinker et al., and may not have been known to them, since the key word “quorum sensing” had not yet been introduced.

It was thus well established by 1981 that autoinduction is independent of cell density and it was tacitly assumed by most workers that its action is at the single-cell level. It is no surprise that a single cell in a small enough volume can activate a quorum-sensing activated gene; a quorum of one is certainly permissible. To my knowledge, quorum sensing was never thought by those knowing the literature to involve cooperativity; the temperature of a closed room occupied by many people may rise with time without any interaction between the individuals, but may cause all persons to remove their coats. This consequence can be said to be due to quorum sensing, and heating the room by other means could be done and have the same effect, even with only one person inside.

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