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Microbial Energetics through a Mist of Maintenance

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There is a general assumption that microbes in soil are experiencing conditions of substrate limitation and starvation, have a slow metabolism, and spend most of limited substrate available on cell maintenance. I will discuss some of the origins of these ideas, discuss the various definitions of maintenance and C use efficiency (CUE), and contrast that to recent measurements of C use efficiency and microbial growth rates. I will further test the assumption by Dijkstra et al (2015) that "amount of glucose added in this study is too low and the duration of the experiment too short to affect microbial metabolism" and discuss how the simultaneous presence of different substrates in the soil environment affect microbial metabolism. Finally, I will test whether microbes are stressed in natural environments using results from 10,601 bacterial genomes, 4,929 metagenome and 1,753 metatranscriptome datasets from a wide range of ecosystems.

I will conclude that 1) maintenance energy demand is a concept that is widely misused in soil ecology, 2) CUE needs to be carefully defined in terms of biochemical efficiency, organic compounds lost from cells, and microbial death, 3) biochemical efficiency does not vary a lot in soil ecosystems, 4) Dijkdtra et al 2015 is wrong and responses to added soluble substrates are near instantaneous, and 5) there is limited evidence that microbes in soil are experiencing starvation.