Real-Time Observations of Chemical and Structural Aspects of *Desulfovibrio vulgaris* and *Caluobacter crescentis* in Atmospheric Oxygen

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ABSTRACT

A long-standing scientific interest in microbial ecology is the contrast responses to the oxidative stress between aerobic and anaerobic bacteria. To day, this has been almost impossible to address directly because of the absence of non-destructive chemical probe. Here we present a real-time comparative study of molecular changes in the aerotolerant *Desulfovibrio vulgaris* cells and in aerobic *Caluobacter crescentis* cells in atmospheric oxygen. Using non-invasive synchrotron radiation-based Fourier transform infrared (SR-FTIR) spectromicroscopy, we successfully measured directly in real-time chemical and structural changes in cellular environments in *D. vulgaris* and in *C. crescentis* during their exposure to air. By comparing measurements, we were able to identify tight temporal changes in chemical bonds, functional groups, and chemical substructures in lipids, DNA, proteins, and polyglucose in *D. vulgaris*. Electron tomography provides direct visual images of the corresponding morphological changes.

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