Physiological role of a squalene-hopene cyclase homolog in *Bacillus subtilis*

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Hopanes and steranes, the lipid end-products of the squalene cyclase gene family, are abundant molecular fossils found in sediments ranging in age from the present to billions of years. Although steranes and some hopanes are thought to indicate the presence of atmospheric oxygen at 2.7 Ga, the physiological roles of these molecules remain largely unknown. Knowledge of their ancient physiological function could be used to constrain the identity of the source organisms and the chemistry and redox state of the paleoenvironment. We are using molecular tools to study a squalene cyclase homolog gene (*sqhC*) found in *Bacillus subtilis*, a spore-producing Gram-positive soil bacterium. We find that the gene is expressed during sporulation and that its protein product localizes to the spore coat. When sporulation occurs under oxidative stress and at low initial pH, *B. subtilis* lacking *sqhC* produces spores that are more sensitive to heat than the spores produced by *B. subtilis* that has a functional copy of *sqhC*. This is the first time a physiological function has been directly established for a bacterial squalene cyclase gene. It has been previously argued that aerobic environmental conditions are required for the production of sterols. In fact, our work demonstrates that at least one squalene hopene cyclase plays a direct role in protecting the bacterium from oxidative stress. If this function is not limited to *B. subtilis*, this would have broad implications for the debate about the timing of the rise of atmospheric oxygen.