

SCHOOL OF BIOLOGICAL SCIENCES SEMINAR

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“Energy generation in a thermophilic sulfur-reducing autotroph”

Many thermophilic autotrophs in deep-sea hydrothermal vents are anaerobes that require H₂ for growth. However, our understanding of how non-methanogenic thermophilic hydrogenotrophs generate energy for growth and adapt to low H₂ conditions is nascent. The autotrophic thiosulfate-reducing bacterium *Desulfurobacterium thermolithotrophum* HR11 was grown at 65°C at high and low H₂ concentrations in serum bottles. It showed a metabolic tradeoff shifting from high growth rate-low cell yield at high H₂ concentrations to low growth rate-high cell yield at low H₂ concentrations. No H₂S was detected when grown on low H₂, and it grew with only CO₂ as the electron acceptor. The organism was then grown at 72°C in a chemostat at 43 µM and 2 µM H₂. At 2 µM H₂, cultures showed a decrease in specific growth rate, maximum cell concentration, and H₂S production. Differential proteomic analysis identified 79 and 66 proteins having more than twofold higher and lower abundances, respectively, under 2 µM H₂ conditions out of 887 total detected proteins. Among these, a membrane-bound ferredoxin-dependent [NiFe] hydrogenase and a cytoplasmic NAD⁺-dependent [NiFe] hydrogenase increased in cells grown on 2 µM H₂. Also, on 2 µM H₂, a membrane-bound menaquinone-dependent [NiFe] hydrogenase increased and likely generated a proton motive force and drove ATP synthesis via a membrane-bound ATP synthase. Cytoplasmic NADH sulfur reductase is the only known sulfur respiration enzyme known in this organism, and it was detected in the proteome and unchanged in abundance with H₂ availability. Four reductive TCA cycle enzymes used for CO₂ fixation were more abundant on 2 µM H₂. These data suggest that hydrogenase and CO₂ fixation enzyme abundances are regulated by H₂ availability and support the idea of a shift in electron disposal towards CO₂ reduction and assimilation on low H₂.

**Hosted by
Biology Graduate Student Association**

**Thursday, October 15th, 2026 at 3:30 p.m.
Hamilton Hall 112**

Zoom Link: <https://unl.zoom.us/j/94081044933>

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