ENERGY IN AN OBLIGATE IRON-REDUCING HYPERTHERMOPHILE. G. Reguera[1] and K. Kashefi[2], Department of Microbiology and Molecular Genetics, Michigan State University, East Lansing, MI 48824, E-mail: [1] reguera@msu.edu and [2] kashefi@msu.edu

Introduction:

Geoglobus ahangari strain 234^T is one of two members of the *Geoglobus* genus within the order Archaeoglobales and the family Archaeoglobaceae. It is an obligate Fe(III)-reducing archaeon isolated from the Guaymas Basin hydrothermal system that grows at temperatures ranging from 65-90°C, with an optimum at about 88°C [1]. It was the first isolate in a novel genus within the *Archaeoglobales* and the first example of a dissimilatory Fe(III)-reducer able to grow autotrophically with H_2 [1], a metabolic trait later shown to be conserved in many hyperthermophilic Fe(III) reducers [2]. *G. ahangari* can also couple the oxidation of a wide range of carbon compounds with the reduction of soluble and insoluble Fe(III), and was the first archaeal species shown to use long-chain fatty acids such as stearate and palmitate as a sole carbon source [1]. It was also the first hyperthermophile reported to fully oxidize acetate to CO_2, a metabolic function once thought to occur solely in mesophilic environments [3].

Energy flow in *G. ahangari*

Obligate nature of Fe(III) use as an electron acceptor. Unlike the other two genera in the family Archaeoglobaceae (*Archaeoglobus* and *Ferroglobus*), which can grow in the presence of acceptors such as sulfate and nitrate, the two cultured members of the genus *Geoglobus* can only utilize Fe(III) as an electron acceptor and grow faster with insoluble than soluble forms of Fe(III) [1]. Analysis of the *Geoglobus* genomes reveals important features about how these archaeal species coupled the oxidation of a large number of electron donors using Fe(III) as terminal electron acceptor. The obligate nature of Fe(III) use as electron acceptor in *Geoglobus* spp. makes the genus an attractive study model to gain insights into the evolutionary mechanisms that may have lead to the loss or gain of genes involved in sulfur and/or nitrogen metabolism within the Archaeoglobaceae. A comparative genomic analysis will be presented [4].

Fe(III) reduction via a direct contact mechanism. Studies in *G. ahangari* have also provided novel insights into the mechanisms that enable hyperthermophiles to access and reduce Fe(III) oxide minerals in hydrothermal vent systems. Cells of *G. ahangari* need to directly contact the insoluble Fe(III) oxides in order to transfer respiratory electrons [5]. The cells are motile via a single flagellum or archaellum [1], which could help the cells locate the oxides [4]. Cells also express numerous curled appendages to bind the metal oxides and position the oxide particles close to heme-containing proteins on the cell's outer surface to facilitate electron transfer [5]. A direct contact mechanism such as this is predicted to confer on these organisms a competitive advantage over other organisms relying on soluble mediators such as metal chelators and electron shuttles, which are energetically expensive to synthesize and are easily diluted or lost in the environment once excreted. This is particularly important in hydrothermal vent systems such as the Guaymas basin chimney where *G. ahangari* was isolated from, as vent fluids flow through the active chimney structures at rates up to 2 m/s [6]. Here, we report the complete genome sequence of *G. ahangari* strain 234^T and summarize the physiological features that make this organism a good model system to study the evolution of Fe(III) reduction in the family Archaeoglobales..

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