GRADUATE AND POSTDOCTORAL STUDIES

McGILL UNIVERSITY

ABSTRACT

What is the cold limit of life? How do microbes survive and grow in cold subzero environments? Most of the earth's ecosystems exist in permanently cold environments where the mean temperature never rises above 15°C. Permafrost,

cryophiles, namely differences in proline, serine, glycine, and aromaticity. Comparing the average of all cryophiles to all mesophiles, we found that overall cryophiles had a much higher ratio of cold adapted proteins for serine (higher serine content), and to a lesser extent, proline and acidic residues (fewer prolines/acidic residues).

Lastly, we performed transcriptomic analyses on two cryophilic permafrost isolates with different growth profiles in order to characterize and compare their low temperature growth and cold-adaptive strategies. The two organisms, sp. JG3 and sp. Eur3 1.2.1, shared several common responses during low temperature growth, including induction of translation and ribosomal processes, upregulation of nutrient transport, increased oxidative and osmotic stress responses, and stimulation of polysaccharide capsule synthesis. Recombination appeared to be an important adaptive strategy for both isolates at low temperatures, likely as a mechanism to increase genetic diversity and the potential for survival in cold systems. While favored upregulating iron and amino acid transport, sustaining redox potential, and modulating fatty acid synthesis and composition, sp. Eur3 1.2.1 increased transcription involved in primary energy metabolism and the electron transport chain, in addition to signal transduction and peptidoglycan synthesis. The increase in energy metabolism may explain why sp. Eur3 1.2.1 is able to sustain growth rates at 0 °C comparable to higher temperature growth. For sp. JG3, flexibility in use of carbon sources, iron acquisition, control of fatty acid composition in membrane, and modulating redox and co-factor potential may be ways in which this organism can grow at subzero temperatures in addition to sustaining growth over a wider range of temperatures

trrmara1(ar)-14(y)ha035-1.1nar aTd[(Foyn)-12(t)-5(he)-20(s)-2(-1294o)-16(n)8(i)3(s 0.s

CURRICULUM VITAE

UNIVERSITY EDUCATION

amino acid traits of cold adaptation in subzero-growing Arctic permafrost bacteria.

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- Moderated meetings and discussions focused on sharpening arguments,