Study reveals function of ubiquitous yet poorly understood microorganisms

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Discovered in the late 1970s, archaea are one of the three main branches on the tree of life, with bacteria and eukaryotes such as plants and animals on the other two branches. But scientists are just now gaining a fuller understanding of what archaea do – in an ecological sense – to make a living.

A new study led by University of Georgia researchers and announced on Wednesday at the American Society for Microbiology meeting in Toronto finds that crenarchaeota, one of the most common groups of archaea and a group that includes members that live in hot springs, use ammonia as their energy source. Chuanlun Zhang, lead author of the study and associate research scientist at UGA's Savannah River Ecology Laboratory, said such a metabolic mode has not been found in any of the other known high-temperature archaea.

"The oxidation of ammonia was not thought to be a dominant process for crenarchaeota, but now we realize how important it is," said Zhang, who is also associate professor of marine sciences. His co-authors include researchers from the University of Nevada Las Vegas, Montana State University, Savannah River National Laboratory, Harvard University and Yunnan University in China.

Zhang and his colleagues (Christopher Bagwell, SRNL; Brian Hedlund, UNLV; Bill Inskeep, MSU; WenJun Li, Yunnan University; Ann Pearson, Harvard; Christopher Romanek and Juergen Wiegel, UGA) sampled extensively from hot springs in the United States, China and

Russia for crenarchaeota and found the widespread distribution of the presumed amoA genes, which microorganisms use to combine ammonia with oxygen, releasing useable energy. Previous studies by other teams used a DNA-based forensic ecology approach to suggest crenarchaeota's role in converting ammonia in mundane environments such as sea water, soil and even waste treatment plants. Zhang said the results of this latest comprehensive study give a picture of the ecological role of crenarchaeota in more extreme environments such as the hot springs.

Because ammonia-oxidizing archaea are associated with a group of microorganisms that thrive in hot spring environments that are thought to resemble early conditions on Earth, Zhang said they may help scientists better understand the earliest stages of evolution on the planet.

"If we want to know how organisms evolved and how their metabolism evolved, we need to understand both the hot springs environment and the low-temperature environment," said Zhang. "Crenarchaeota are special because they thrive in both environments."

Source: University of Georgia