JS1-4:

Isolation, physiology, and genomics of novel nitrifiers

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After bacterial chemoautotrophy on nitrification was discovered by Sergei Winogradky more than a century ago, nitrification research developed steadily but with slow progress. Nitrification consists of two step reactions, ammonia oxidation by ammonia-oxidizing bacteria or archaea and nitrite oxidation by nitrite-oxidizing bacteria. These nitrifiers are key players in the biogeochemical nitrogen cycle and biological wastewater treatment. Traditionally, biochemical and physiological properties of these microbes had been characterized based on the studies using representative pure strains, which have often been isolated. Recently, however, cultivation-independent molecular methods and environmental genomics have unveiled the phylogenetic diversity and environmental distribution of yet uncultured nitrifiers. Therefore, a game changing technology allowing high throughput isolation is strongly required for comprehensive understanding of their physiology and ecology. In this symposium, first, I will report a novel cultivation and isolation strategy for uncultured nitrifiers. The method combines 1) selective enrichment using a continuous feeding bioreactor, and 2) purification by a cell sorting system on the basis of the unique morphological characteristics of nitrifiers. The goal of this methodological study is to isolate different types of uncultured nitrifiers from various environmental samples or enrichment cultures and to demonstrate availability of this method. Secondly, I will talk about physiological and genomic characteristics of isolated novel nitrifiers, introducing current trends in the field of nitrification. Comparative physiological characteristics of pure strains revealed functional diversity and niche differentiation in environment Genomic approaches also illuminated unexpected function of nitrifiers. These discoveries open a new window of nitrification research breaking down conventional stereotypical views.

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