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## Lanthanide-dependent enzyme and motility in plant-associating methylotrophic bacteria

Plants emit large quantities of methanol through stomata as a result of their growth and pectin degradation. Methanol can be a good nutrient for bacteria and methanol-utilizing (methylotrophic) bacteria predominate on the aerial plant surface (phyllosphere). We focus on their methanol metabolism and symbiosis with plants.

*Methylobacterium* species are commonly found in phyllosphere, and they can promote plant growth. They have methanol dehydrogenase (MDH) to oxidize methanol. Not only calcium-dependent MDH encoded by *mxhA*, recently it was found that lanthanide-dependent MDH is also encoded by *xoxF* in the genomes of *Methylobacterium* species. This is the first enzyme described to date, to contain lanthanide. We investigate the mechanism of expression switching between these MDHs, depending on the availability of lanthanide.

We also study molecular mechanism of the motility and chemotaxis in methylotrophs, which is important for the bacteria to find and colonize plants. The chemotaxis is also affected by the carbon source and lanthanide.

We have found new methylotrophic bacteria belonging to novel genera. They have been isolated from rice rhizosphere using lanthanide as an essential cofactor. They are named as *Oharaeibacter diazotrophicus* SM30 and *Novimethylophilus kurashikiensis* La2-4. Thus, lanthanide can be used for isolation of bacteria that contain *xoxF*, which can be found in many so-believed non-methylotrophic bacteria and novel bacteria.



*Methylobacterium aquaticum* strain 22A



Strain 22A adhering plant root hair



Strain 22A chemotaxis toward methanol



*Novimethylophilus kurashikiensis* La2-4