Explaining widespread vitamin B1 auxotrophy amongst bacterioplankton using competitive co-culture experiments.

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Bacterioplankton require thiamin (vitamin B1) to survive, yet most taxa are B1 auxotrophic and cannot synthesize the vitamin de novo. Thus, uptake and use of exogenous B1 is anticipated to be a highly advantageous lifestyle compared to de novo synthesis (B1 prototrophy). However, there is little direct experimental evidence that B1 auxotrophy is more advantageous than prototrophy – and no evidence amongst marine plankton. Because prototrophs need more enzymes to synthesize B1, it is speculated that auxotrophs (that lack these enzymes) have lower energic or elemental costs and can better compete. We directly examined this hypothesis using co-cultures of prototrophic wild-type *Vibrio anguillarum* PF430-3 grown with auxotrophic mutants under replete and macronutrient-limited conditions. Flow cytometry and qPCR were used to monitor the specific growth of each strain in these mixed co-cultures. Mutants without the pyrimidine precursor synthesis gene *thiC* grew faster than the wild-type following the onset of nutrient limitation, and all auxotrophic mutants (*thiG* – thiazole synthase, *thiE* – thiamin phosphate synthase) reached higher cell concentrations than the wild-type under phosphorus-limited conditions. These results demonstrate growth advantages of auxotrophy over B1 synthesis when cells are limited by macronutrients (C, N, P) and give direct evidence as to why *thiC* auxotrophy is widespread among bacterioplankton globally. Other factors such as B1 (radioisotope) uptake rates will be presented to further explain the observed growth differences.