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Evolution of Metabolic Dependency[1]

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Microbes are often found to have lost their ability to make essential metabolites (auxotrophs) and instead rely on other individuals for these metabolites. How might metabolic dependency evolve to be so common? When microbes live inside a host (endosymbionts), amply host metabolites support auxotrophic endosymbionts. If the host transmits only a small number of endosymbionts to its offspring, then auxotrophic endosymbionts can rise to high frequency simply by chance. On the other hand, auxotrophs have also been observed in abundant free-living bacteria found in ocean water where nutrient supply is low. How might auxotrophs rise to an appreciable frequency in a large population when nutrient supply is low? We have found commonly-encountered conditions that facilitate the evolution of metabolic dependency. Metabolic interactions can in turn shape spatial organization of microbial communities (Momeni et al. (2013) eLife 2, 00230; Momeni et al. (2013) eLife 2, 00960; Estrela and Brown (2013) PLoS Comput Biol 9, e1003398; Muller et al. (2014) PNAS 111, 1037-1042). Rapid evolution of metabolic dependency can contribute to the complexity of microbial communities.

[1]Evolution of metabolic dependency