

Which species concept for cyanobacteria? The genus *Planktothrix* as a case study

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By definition, a species is a coherent cluster of individuals with equivalent biological characteristics and reproductively isolated from individuals belonging to other species. According to a widely accepted conceptualization, valid for both multi- and unicellular eukaryotes, species are maintained in time and reinforced by sexuality (genetic recombination), which is possible only between compatible individuals (i.e. prone to generate fertile offspring) (Ernst Mayr, 1949; several authors, up to date). For instance, among eukaryotic microalgae, the dominant clonal reproduction is periodically interrupted by sex, which counterbalances the divergence between clonal populations, so that to enhance the genetic, phenotypic, ecological coherence within each species. Paradigmatically classified as microalgae, cyanobacteria are proper bacteria, organisms with virtually no sexual isolation. This evolutionary plasticity led (cyano)bacteriologists to ask themselves if prokaryotic species actually exist and which criteria should be used to define them. In general terms, bacterial speciation is promoted by the periodic selection for different adaptive traits in distinct populations, which become isolated, physically or ecologically (and, consequently, in terms of gene flow). Nonetheless, bacterial “species” (or better, ecotypes) are still compatible until their genome has diverged to the extent that recombination is highly improbable, because of cellular mechanisms acting as primitive sexual barriers. Thus, when their niche or physical separation collapses, different congeneric bacterial ecotypes can recombine and produce new clones, less divergent than the parental ones and potentially fitter into new environments. *Planktothrix* is one of the most studied cyanobacteria genera; nonetheless, only few species were defined so far based on ecological, molecular, biochemical, as well as morphological characteristics. In this presentation, I give an overview of potential speciation processes acting in natural populations of this genus, featuring ecologically determinant and deterministic selective pressures, to apparently neutral and stochastic recombination events. My main aim is to stimulate discussion about which species concept should apply to *Planktothrix* and, consequently, to cyanobacteria, considering their potentially chaotic evolutionary dynamics.