



In Natural Environments, Actinomycetes Live in Dynamic Communities and Environmental Cues and Ecological Interactions

Charline Hoebreck*

Department of Plant and Microbial Biology, University of California at Berkeley, Berkeley, USA

*Correspondence: Charline Hoebreck, Department of Plant and Microbial Biology, University of California at Berkeley, Berkeley, USA, Email: sylvie.quideau@gmail.com

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DESCRIPTION: The Actinomycetales is an order of Actinomycetota, any member of a heterogeneous group of gram-positive, generally anaerobic bacteria noted for a filamentous and branching growth pattern that results, in most forms, in an extensive colony, or mycelium. The mycelium in some species may break apart to form rod- or coccid-shaped forms. Many genera also form spores; the sporangia, or spore cases, may be found on aerial hyphae, on the colony surface, or free within the environment. Motility, when present, is conferred by flagella. Many species of actinomycetes occur in soil and are harmless to animals and higher plants, while some are important pathogens, and many others are beneficial sources of antibiotics. A member of the order is often called an actinomycete. Actinomycetales are generally gram-positive and anaerobic and have mycelia in a filamentous and branching growth pattern. Some actinomycetes can form rod- or coccid-shaped forms, while others can form spores on aerial hyphae. Actinomycetales bacteria can be infected by bacteriophages, which are called actinophages. Actinomycetales can range from harmless bacteria to pathogens with resistance to antibiotics. Actinomycetales have 2 main forms of reproduction: spore formation and hyphae fragmentation. During reproduction, Actinomycetales can form conidiophores, sporangiospores, and oidiospores. In reproducing through hyphae fragmentation, the hyphae formed by Actinomycetales can be a fifth to half the size of fungal hyphae, and bear long spore chains. The Actinomycetota (or Actinobacteria) are a phylum of all gram-positive bacteria. They can be terrestrial or aquatic. They are of great economic

importance to humans because agriculture and forests depend on their contributions to soil systems. In soil they help to decompose the organic matter of dead organisms so the molecules can be taken up anew by plants. While this role is also played by fungi, Actinomycetota are much smaller and likely doing not occupy the same ecological niche. In this role the colonies often grow extensive mycelia, like a fungus would, and the name of an important order of the phylum, Actinomycetales (the actinomycetes), reflects that they were long believed to be fungi. Some soil actinomycetota such as *Frankia* live symbiotically with the plants whose roots pervade the soil, fixing nitrogen for the plants in exchange for access to some of the plant's saccharides. Other species, such as many members of the genus *Mycobacterium*, are important pathogens. Actinomycetes, filamentous action bacteria found in numerous ecosystems around the globe, produce a wide range of clinically useful natural products (NP). In natural environments, actinomycetes live in dynamic communities where environmental cues and ecological interactions likely influence NP biosynthesis. Our current understating of these cues, and the ecological roles of NP, is in its infancy. We postulate that understanding the ecological context in which actinomycete metabolites are made is fundamental to advancing the discovery of novel NP.

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