Trotsenko, Yu.A., Doronova, N.V., and Torgonskaya, M.L. Aerobic Methylobacteria. Pushchino: ONTI PSC RAS, 2010

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The reviewed book consisting of seven chapters, a conclusion, an appendix, and a list of 839 references has first analyzed and generalized the newest information on the biology of aerobic of methyltrophic bacteria (methylobacteria) using a wide spectrum of oxidized and substituted methane derivatives as energy and carbon sources.

A brief introduction to the problem of methyltrophy as a specialized nutrition type of microorganisms and historical essay consider the main development stages of the ideas about the taxonomy, ecophysiology, vitally important role of aerobic methylobacteria and their unique metabolic and genetic organization, and analyze the hypotheses explaining the causes of obligate dependence on C_1 compounds.

Modern data on the ubiquity, and taxonomic and physiological-biochemical versatility of aerobic methylobacteria using methanol, methylated amines, halomethanes and methyl sulfur compounds, as well as methyl acetate and methyl-tret-butyl ether as the carbon and energy sources, are summarized below. The multiple pathways of primary oxidation of these substrates and key genes/enzymes responsible for the corresponding reactions are considered in detail.

A special section devoted to describing the biodiversity and main properties of extremophilic/tolerant aerobic methylobacteria analyzes the main adaptive mechanisms and survival of halo(alcalo)philic methylobacteria under the conditions of high salinity—the biosynthesis and accumulation of osmoprotectants (ectoine, glutamate, sucrose), including the genetic and regulatory aspects of synthesizing the dominant osmoprotectant ectoine.

A separate chapter considers the physiological and biochemical properties and role of aerobic methylobacteria as phytosymbionts, their distribution, their capability of stimulating the growth and development of plants, mechanisms of interaction with plants, and adaptation to multistress conditions of epiphytic growth.

The authors have first summarized and analyzed the data of genoproteomic research on aerobic methylobacteria and noted the evolutionary relations of different methyltrophes between each other and with other groups of microorganisms, as well as the possibility of forecasting the capability of bacteria for methyltrophy based on the presence of the complete set of genetic determinants of methyltrophic modules.

The monograph reflects the modern state and prospects of implementing the unique metabolic potential of aerobic methylobacteria in different fields of biotechnology for the production of biopolymers, enzymes, and bioprotectors (ectoine); the degradation of different toxic single- and polycarbon compounds; and the bioremediation of polluted ecosystems.

The conclusion gives the main results of the research pursued in the last decades; places a particular emphasis on the achievements that have resulted in better understanding of the ecology, metabolism, genetic, and phylogeny of aerobic methylobacteria; and sets the key directions of future research.

The appendix briefly describes the modern approaches used when studying aerobic methylobacteria in natural ecotopes, including the classical microbiological, biochemical, and newest methods for detection and identification, and main primer systems and probes and gives the estimation of their specificity. The diagnoses of the known and new validated genera of methylobacteria are presented.

The book was written and designed with a high professional level and is illustrated well with evident color schemes, which makes it easy to understand the sufficiently difficult aspects of the metabolic and genetic organization of aerobic methylobacteria. The monograph is intended for specialists, readers of universities, postgraduates and students studying the fundamental and applied aspects of methyltrophy and is of undoubted interest for a wide audience.