Microbial oxidation and reduction of Fe and Mn are of wide-ranging importance to soil scientists (Alexander, 1977; Paul & Clark, 1989). Indeed, knowledge of the distribution, abundance, identity, and activity of Fe- and Mn-transforming microbes in soils and sediments can greatly enhance studies on such diverse agricultural and environmental problems as Fe and Mn availability to plants, metal accumulation, toxicity and mobility of metals and pesticides, and clogging in wells and wetland drainage systems. Knowledge of the biology of Fe- and Mn-transforming microorganisms may allow for future applications in which the metal mobilization and immobilization activities of these microorganisms are exploited for economic and environmental benefit (Ehrlich & Brierley, 1990). Except for the morphologically recognizable “iron bacteria,” relatively little is known of the occurrence of Fe-Mn-transforming organisms in nature. Even less is known of their function in natural systems or the factors controlling their in situ activities. On the other hand, several model organisms have been isolated and characterized taxonomically (e.g., Thiobacillus ferrooxidans, Leptothrix discophora, Shewanella putrefaciens, and Geobacter metallireducens (Lovley et al., 1993)). In some cases, the biochemical mechanisms underlying their Fe- and Mn-transforming abilities have been investigated. (For reviews, see Ghiorse 1984, 1988; Ehrlich, 1987, 1990; Lovley, 1987, 1991; Nealson et al., 1988, 1989; Myers & Nealson, 1990; Ehrlich et al., 1991; Nealson & Myers, 1992).

A persistent problem has been the difficulty of distinguishing abiotic from biologically mediated (biotic) transformations, especially in environments like soil where microbial activity may alter the redox chemistry of the microenvironment, causing Fe and Mn redox changes to occur by direct or indirect mechanism (Ehrlich, 1990). These problems also apply to microbial growth media which, in some instances, may be altered by growth-induced changes in pH or $E_h$ or metabolic products that cause chemical oxidation or reduction of Fe and Mn. These possibilities are taken into...