

Mechanisms for the Control of Mitochondrial Distribution and Morphology

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Cellular function and proliferation depend on mechanisms that regulate the morphology of mitochondria and ensure the transmission of mitochondria to daughter cells prior to cell division. Some of the molecular components that mediate these critical processes have been identified through the isolation and analysis of yeast mutants that display defects in mitochondrial dynamics. These components include Mdm1p, an intermediate filament-like protein of the cytosol, and three proteins of the mitochondrial outer membrane, Mdm10p, Mdm12p, and Mmm1p. Analysis of these mutants has also revealed an essential role for ubiquitination in mitochondrial inheritance in *Saccharomyces cerevisiae*. Genetic and molecular analysis of another mutant, *mdm17*, has led to the identification of three components that act at the mitochondrial outer membrane to mediate the fission of mitochondrial tubules. Additional studies using the yeast *Schizosaccharomyces pombe* are revealing components important for the movement of mitochondria along microtubules, an important aspect of mitochondrial positioning in animal cells. One such *S. pombe* component is Mmd1p, a novel 36 kDa protein conserved in a wide variety of eukaryotic cells. These studies should lead to new insights into mitochondrial behavior and the coordination of mitochondrial dynamics with cell division and differentiation.