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Role in Recombination of Genes That Control Meiotic Cell Divisions

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Abstract

The production of gametes in Saccharomyces cerevisiae via meiosis is under strict regulatory control where proper segregation of homologous chromosomes into gametes requires physical linkage via crossovers. Cells that initiate meiotic recombination but do not process programmed double strand breaks into crossovers enter meiotic arrest. The main goal of the current project was whether overexpression of gene Y is sufficient to bypass the meiotic arrest in prophase I exhibited by dmc1 deletion and a zip1 mutant that carries an internal deletion. DMC1 is a recombinase that promotes homologous recombination. ZIP1 is a transverse filament protein of the synaptonemal complex (the structure that forms between homologous chromosomes) and is integral in homologous recombination and proper segregation of chromosomes. Gene Y encodes a protein of unknown function in the S. cerevisiae genome that we tagged with GFP and overexpressed using an inducible promoter. Our main goal was to determine the minimum concentration of a given inducer at which gene Y is sufficiently overexpressed to bypass the arrest. We found that when overexpressing gene Y, the meiotic arrest is bypassed fully for cell cultures in sporulation medium with induction at both t=3.5 hours and 6.5 hours, over the span of 24 hours in synchronous meiotic cultures. There was also a bypass of the meiotic arrest in both the high and low concentrations of inducer added to the meiotic cultures. Bypass is achieved at the lower concentration, where there is reduced chance of induce toxicity.