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Identification of Factors that Mediate Strand Exchange During Early Meiosis at Low Double Strand Break Levels

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Abstract

Genetic recombination is essential in order to create diversity amongst all of the genetic information. Crossovers also contribute to segregation of homologous chromosomes to opposite spindle poles during the first meiotic division. Meiotic strand exchange in *Saccharomyces cerevisiae*, budding yeast, aims to diversify genetic information in the resulting gametes which in budding yeast are called spores. While Dmc1 and Rad51 are two proteins that are known to play a role in double strand break (DSB) repair, the exact function of Rad51 is still unclear. It is known that Rad51 is responsible for strand exchange in mitosis, but it is still present in meiosis, even when Dmc1's catalytic strand exchange activity alone is sufficient for repairing DSBs into crossovers. In this project, we carried out a budding yeast strain construction to identify the function of three proteins in strand exchange during early meiosis, when nucleus-wide DSB levels are low. So called Spo11 hypomorphs were used to lower DSB levels during meiosis and thus mimic the conditions of early meiosis. Spo11 hypomorphs express a version of the DSB forming topoisomerase homolog Spo11 that exhibits reduced activity. Three strains (A, B and C) which express a catalytically inactive version of the A gene, or a presumed activator of the A protein, were mated with a Spo11 hypomorph, and haploid spores were derived from diploid precursor cells. Double and triple mutants were identified based on antibiotic marker genes associated with the respective mutations. Southern blot analysis was used to confirm the presence of the relevant mutations in genomic DNA extracted from spore offspring. We hypothesize that during early meiosis at low DSBs, a distinct subset of proteins, including genes A and B, mediate strand exchange during homologous recombination, with protein A functioning as a potential activator of protein B.