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MASTER REGULATORS OF COLONY MORPHOLOGY SWITCH IN YEAST *S. CEREVISIAE*

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Colony morphology is a fascinating phenotype described in unicellular organisms as a possible step towards multicellularity.

We studied the environmental determinants of a specific type of morphology, called filigreed morphology. This phenotype first described by Cavalieri et al in 1998 and 2000 as present in heterozigosity in one *S. cerevisiae* strain from grapes of the Montalcino area, naturally reverts to normal colony morphology with a reversion rate that is dependent on the carbon source. We measured gene expression in cells grown in fermentable and non-fermentable carbon sources and used pathway analysis to evaluate the genetic determinants of filigreed phenotype. Our results support the hypothesis of an ecological function of filamentous phenotype in creating a community adaptable to the shifts of the environmental conditions. Ethanol is the main fermentation product and enables *S. cerevisiae* to inhibit the growth of other microorganism competing for space and nutrient. The increase in ethanol concentration is correlated to the decrease of fermentable sugars; in this perspective the stable and uniform morphotype, induced by ethanol, could reflect an adaptation to starvation and stress. The adaptive role of morphogenesis is further supported by the increased capability of this strain to invade agar, demonstrating a correlation between invasiveness, filamentous morphotype and pseudohyphal growth. Next-generation sequencing (NGS) of the sporal derivatives allowed to discover mutations in genes candidate to be the genetic determinants of the colony morphology phenotype. The combination of the results led to hypothesize that the colony morphology is dependent on "symmetric" processes resulting from synchronization of several genetic sub-networks involved in RAS signaling, bud site selection, cell cycle regulation and cell-cell adhesion.