Abstract

The yeast *Saccharomyces cerevisiae* on solid media forms multicellular colonies. Cells within colonies undergo differentiation and metabolic diversification, including formation of two layers of cells called Upper and Lower cells. The metabolic activity of U and L cells is different. For instance a higher level of autophagy was observed in U cells. This thesis includes a literature review of molecular mechanisms of autophagy in yeasts. Yeast colonies, under starvation conditions, produce volatile ammonia signal. This signal allows them communicate over a distance. Studies, revealing cell differentiation within colonies and ammonia signalling among colonies, were performed in colonies of laboratory strains. Strains isolated from nature, so-called wild strains, form distinct structured colonies, termed fluffy. Yeast within fluffy colonies also form different cell types. However the situation seems to be more complex that within smooth colonies of laboratory strains. Strains were constructed during this study, which express marker proteins Icl2p, Pox1p, Mae1p, Pma1p, Pma2p, Ino1p, Met17p and Atg8p fused with fluorescent labels in order to study cell differentiation and other processes within fluffy colonies. Furthermore, a new system for measuring ammonia signalling in microcolonies of wild yeast strains was established. During this project it was found, that microcolonies of wild yeast strains produce volatile ammonia in pulses with similar timing to that, observed in microcolonies of laboratory yeast strains. Parallel measurement of ammonia production and observation of fluorescence of fusion proteins Ato1p and Icl2p in microcolonies of wild yeast strains revealed a correlation between their fluorescence and ammonia signalling. Furthermore laboratory yeast strains expressing fluorescently-tagged marker proteins Icl2p, Cyc2p and Om45p were constructed and production of these proteins during colony development was observed. The production of fusion proteins Icl2p-GFP and Cyc2p-GFP in colonies of laboratory yeast strains revealed a correlation between changes in their production and ammonia signalling. This thesis is a starting point for the investigation of cell differentiation and ammonia signalling in colonies of wild yeast strains.

Key words: *Saccharomyces cerevisiae*, colony, yeasts, ammonia, autophagy