Analysis of yeast colony structure: peroxisomes and autophagy

Abstract

This study is a part of the project „Molecular biology and physiology of yeast communities“. Yeast colonies grown on solid complex medium communicate by periodical release of volatile ammonia (PALKOVÁ et al. 1997), which is accompanied by periodical alkalization of colonies and growth substrate. Transition of colonies to the ammonia producing period of their life is accompanied by global changes of gene expression, as was shown using RNA microarrays (PALKOVÁ et al. 2002). Changes in many metabolic genes were observed, indicating activation of peroxisomal fatty acids β-oxidation, activation of glyoxylate cycle enzymes and inhibition of mitochondrial oxidative phosphorylation. These data suggest a significant switch of cellular metabolism during early alkali phase, based on peroxisomal induction and mitochondrial decline. This switch could be facilitated by autophagy, the process which can selectively or non-selectively remove unnecessary cellular components, providing the cell with energy and removing parts interfering with the new metabolism. *Saccharomyces cerevisiae* strain expressing peroxisomal GFP was constructed in order to visualise peroxisomes and strain containing GFP-tagged autophagic protein Atg8p was prepared to monitor autophagy. Using the new approach of microscopic analysis of colony structure, at least two distinct horizontal cell layers, which differentiate during early alkali phase, were characterised. Induction of peroxisomes and autophagy was observed exclusively in the upper one. The ultrastructure of cells located at these two layers was analysed using electron microscopy in more detail. This pilot study contributed to our knowledge of yeast colony structure and development. However, more investigation will be required to comprehend mechanisms involved in cell differentiation within yeast colonies.

Keywords: *Saccharomyces cerevisiae*, yeast colony, ammonia signalling, communication, autophagy, peroxisomes