

## Abstract

Yeast colonies are, alongside to bacterial biofilms, multicellular communities formed by unicellular microorganisms. These specific communities differ in many ways from populations cultivated in planktonic cultivations. Gradients of nutrients, metabolic by-products and other factors are formed and preserved within these structures, which provides a basis for cellular differentiation. Current literature concerning these issues with emphasis on yeast colonies and biofilms is summarised in the Introduction of this work. Section Results then describes my contribution to the knowledge on the differentiation of the colonies of *Saccharomyces cerevisiae* as a model system for studying microbial multicellular structures. Previously described horizontal differentiation, i.e. differentiation between colony centre and margin, is further characterised with respect to ammonia signalling and stress resistance. The importance of genes conferring the cell's oxidative stress resistance in colony differentiation was studied and it was concluded that not stress resistance but rather metabolic and other changes promoted by ammonia signal are important for colony differentiation and survival. A new type of colony differentiation – the horizontal, i.e. differentiation between upper and lower part of the colony, is described in this work. Cells within the upper and lower region of differentiated colony differ markedly in their expression profile, physiology, metabolism, stress resistance and other factors. Cells of the upper layer are larger, highly stress-resistant, they accumulate energy reserves and activate specific metabolic pathways resembling tumour metabolism. On the other hand, cells of the lower layer are smaller, bear signs of stress and starvation, activate degradative processes and, surprisingly, also respirative metabolism. It was proposed that these cells provide nutrients for the upper cells to grow and survive. The differentiation is presumably regulated by the GCN, TOR and SNF pathways.