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Evolution of gene expression in yeast and in cancer

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A major challenge for molecular evolutionary dynamics is to understand how adaptive changes in gene expression programs occur when organisms face new environments. In my talk I will describe two such processes. In the first we will discuss the surprising role of chromosome duplication during adaptation to stress. I will describe our lab-evolutionary platform in which yeast evolve to gain new stress-coping capabilities. An emergent recurring dynamics in such experiments is that in each a different chromosome is selected to be duplicated, gaining stress tolerance capacity. Yet such genomic structural changes appear to be short lived and are replaced by more refined economic and long enduring solutions. Thus gross duplication appear as a "quick and dirty" adaptation that later facilitates more refined solutions. In the context of cancer we study genome - wide changes in the program of gene translation that is mediated by adaptive changes in the tRNA pool. We discover that such recurring changes in the tRNA pool are selected for because of their proliferative-promoting effects, predominantly on oncogenic genes. This project thus exposes a new layer of regulation that appears under strong selection in diverse cancers, that is responsible for the conversion of the transcriptome to a more "pro-proliferation" proteome.