

Peroxisome Proliferation and Maintenance in Yeast and Human Cells

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Dynamic changes of membrane structure are intrinsic to organelle morphogenesis and homeostasis. Peroxisomes are versatile single membrane-bound organelles that enclose essential functions mainly involved with lipid metabolism. While peroxisomes are dispensable for unicellular organism such as yeast cells, they are essential for the proper development of multicellular organisms. Peroxisomal dysfunction can lead to severe pathological disorders such as adrenoleukodystrophy or the Zellweger syndrome spectrum that are typically lethal diseases. Peroxisomes continuously adjust their shape, size, number and protein content according to the metabolic requirements of the cell. Accordingly, molecular mechanisms exist that maintain the number and morphology of peroxisomes in the cell. Several membrane proteins have been shown to participate in the process of peroxisome proliferation in yeast and mammalian cells. We employed a dual approach based on quantitative proteomics and live-cell imaging to analyze molecular networks involved in the regulation of peroxisome proliferation. The results of our studies in yeast cells reveal that macromolecular membrane proteins complexes link peroxisomes to other sub-cellular organelles. Additionally, we illustrate the asymmetric inheritance of peroxisomal matrix proteins in the process of proliferation in mammalian cells a mechanism they may lead to rejuvenation of the peroxisome pool in the cell.