

Cd^{2+} and Zn^{2+} induce autophagy in the *Saccharomyces cerevisiae*.

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ABSTRACT

It is generally considered that autophagy can selectively remove or isolate the damaged macromolecules and organelles, and even facilitate cells death. Such mechanism is to avoid these particles or cells disturbing normal cellular functions and physiology. The purposes of this study are to test the conditions that excess cadmium (Cd^{2+}) and Zinc (Zn^{2+}) induce autophagy. Based on the experimental data, we found that cadmium and zinc inhibit the growth of yeasts at $10\mu\text{M}$ and 5mM , respectively. Excess heavy metal actually induced autophagic protein expression and caused autophagosomes accumulated in the vacuole of protein-deficient yeast cells. Our results show that there are close connections between heavy metal toxicity and autophagy induction in the yeast. With further characterization of the molecular mechanisms of the autophagy and the cytoplasm to vacuole targeting pathways, it may help us to understand and handle the issues of heavy metal toxicity in higher organisms.

Key words: autophagy, cadmium ion, zinc ion, yeast

鎘離子與鋅離子對出芽酵母菌細胞自噬的誘導研究

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摘要

一般認為細胞自噬(*autophagy*)可選擇性去除或隔離受損的巨分子及胞器，甚至促成細胞死亡，來避免這些物質或細胞干擾正常生理功能。本實驗的目的在於探討鎘離子和鋅離子引發酵母菌細胞自噬的情形。經試驗得知，鎘與鋅的濃度分別在10 μ M與5mM對酵母菌的生長有抑制的現象，我們用西方氏轉漬法觀察發現，以重金屬處理的酵母菌的確誘發了更多細胞自噬蛋白質的產生，另外我們也使用干涉相位差顯微鏡觀察其外部型態與液泡內的物質，發現以重金屬處理的酵母菌液泡中有較明顯的顆粒分子，推測是受損的巨分子及粒線體等胞器。我們的研究結果顯示，重金屬對酵母菌細胞自噬的生理表現有密切關聯，未來對細胞自噬基因達成選擇性傳遞—細胞質至濾泡傳遞途徑(*Cytoplasm-to-Vacuole Targeting pathway*)的機制有進一步認識後，便有助於了解並解決重金屬對生物的毒害。

關鍵詞：細胞自噬、鎘離子、鋅離子、酵母菌