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Towards water-free biobanks: long-term dry-preservation at room temperature of desiccation-sensitive enzyme luciferase in air-dried insect cells

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Abstract

© 2017 The Author(s). Desiccation-tolerant cultured cells Pv11 derived from the anhydrobiotic midge embryo endure complete desiccation in an ametabolic state and resume their metabolism after rehydration. These features led us to develop a novel dry preservation technology for enzymes as it was still unclear whether Pv11 cells could preserve an exogenous enzyme in the dry state. This study shows that Pv11 cells protect an exogenous desiccation-sensitive enzyme, luciferase (Luc), preserving the enzymatic activity even after dry storage for 372 days at room temperature. A process including preincubation with trehalose, dehydration, storage, and rehydration allowed Pv11 (Pv11-Luc) cells stably expressing luciferase to survive desiccation and still emit luminescence caused by luciferase after rehydration. Luminescence produced by luciferase in Pv11-Luc cells after rehydration did not significantly decrease in presence of a translation inhibitor, showing that the activity did not derive from de novo enzyme synthesis following the resumption of cell metabolism. These findings indicate that the surviving Pv11 cells almost completely protect luciferase during desiccation. Lacking of the preincubation step resulted in the loss of luciferase activity after rehydration. We showed that preincubation with trehalose associated to induction of desiccation tolerance-related genes in Pv11 cells allowed effective in vivo preservation of enzymes in the dry state.

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