

Abstract for the general public

Molecular function of zinc storage in ribosomal proteins of eukaryotic cells

To live, animals require macronutrients such as proteins, sugars, and fats as well as micronutrients such as vitamins and minerals. Micronutrients are essential dietary elements that fulfil various physiological functions in the body to assure health. Micronutrients are, for example, cofactors of enzymes and are necessary for their activity. One such element is zinc which we absorb from food such as meat, beans, and nuts. Zinc deficiencies in humans occur mostly because of insufficient dietary intake, deficiency in absorption or increased loss or body system use. Consequences of zinc deficiency in humans include, among others, impaired immune system and wound healing, diarrhoea, loss of cognitive function such as learning ability and the capability to characterize and categorize emotions. Zinc deficiency in children leads to growth retardations and can interfere with metabolic processes during infancy and childhood during rapid growth and development when nutritional needs are high.

25% of world population are at risk of zinc deficiency and this includes elderly people. Dietary supplementation with zinc in elderly is recommended and has been shown to increase protective responses against viral infections and improve cognitive functions.

However, the intake of zinc must be highly regulated by the body because too much of this nutrient is toxic. Thus, the body ensures mechanisms that recognize the levels of zinc in the cell and react with increased uptake or increased release of zinc from the cell. Because itself zinc is toxic, it is, to a large extent, bound by proteins in the cell. The function of these zinc-binding proteins depend on the zinc itself. Interestingly, few types of proteins that are very abundant in the cell maintain up to 90% of internal zinc storage. These include proteins of the ribosome, a large complex necessary to produce new proteins. Little is known how cells react if physiological levels of available zinc are low, such as during aging. Within this project we want to study if ribosomes are able to release their bound zinc to provide it for other proteins to fulfil their normal function. We will study the mechanism how the zinc is released, to which proteins it will be delivered and what kind of consequences the release of zinc has for the function of the ribosomes itself. Moreover, we want to understand if the supplementation with zinc in an aged organism replenishes the ribosomal zinc storage.

Basic research in understanding zinc biology during aging is important to identify factors that are needed to sustain health during aging and possibly develop strategies to treat aging-related disorders.