DIFFERENTIAL EFFECTS OF CADMIUM AND MERCURY ON LYSONOMAL ENZYMES IN THE KIDNEY OF MYXINE GLUTINOSA


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INTRODUCTION

In man and most animals the exposure to the environmental pollutants cadmium and mercury results in accumulation of these heavy metals especially in the kidneys and the liver. At the cellular level protein-bound heavy metals are enriched in the lysosomal system after pinocytotic uptake.

The aim of the present study was to show:

a) the validity of hagfish (Myxine glutinosa) as an animal model for the investigation of renal lysosomal enzymes. The archinephric duct of Myxine is comparable in ultrastructure to the first segment of the proximal tubule in mammals and also capable for extensive uptake of macromolecules from the luminal fluid (Ericsson and Seljelid, 1968),

b) the effects of cadmium and mercury on acid phosphatase (AcPase) and proteinases cathepsins B and L in lysosomes of kidney cells.

METHODS

Studies on renal AcPase and cathepsins were performed on hagfish (body weight 31-71g) which had been caught at the coast of Maine (USA) and the Oslo Fjord (Norway), respectively. Kidney tissue (Archinephric duct) was excised from anaesthetized animals (propylenphenoxetol, 2 ml/l seawater) after pressure controlled perfusion with Ringer's solution to remove the blood. The activities of AcPase and cathepsins were measured by fluorometric ultramicroassays utilizing 4-methylumbelliferylphosphate, Z-phenylalanyl-arginine-7-amido-4-methylcoumarine and N-CBZ-L-arginyl-arginine-7-amido-4-methylcoumarine, respectively, as the substrates (Olbricht et al. 1984, 1986). Test substances were added directly into the reaction mixture.

RESULTS

Characterization of cathepsins B, L in the kidney of Myxine

1. No enzyme degradation occurs at the incubation temperature of 37.5 °C which is unphysiological for the hagfish, but comparable to studies on
Figures 1 and 2. Effects of incubation temperature and inhibitors on the activity of cathepsins B, L.