

TOXIC EFFECT OF HEAVY METALS ON THE IMMUNOCOMPETENT CELLS OF FISH

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Introduction

The pollution of sturgeons habitats by heavy metals unfavourable effects fish organism, including immune system (O'Neill,1981; Thuvander,1988; Saxena et al.,1992). The immune functions of fish, as the other vertebrates, is provided by the special system of cells: lymphocytes, plasma cells, macrophages and granulocytes. In the present work the fine structure of immunocompetent cells of young *Acipenser baeri* hatus chronically exposed to sublethal concentrations of heavy metals was studied.

Results

The sturgeons (weight 6-12g) were maintained in 250 l tanks at 15 °C. In these tanks sublethal concentrations of heavy metals (0.015 mg/l Cu²⁺, 0.003 mg/l Hg²⁺, 0.03 mg/l Cd²⁺) were kept using the diluter system.



Figure 1 Small lymphocyte with a few mitochondriae(m), control.

The blocks of fish kidney and spleen were studied as they are hemopoietic organs. The fixation and following processing of material were made according to generally accepted methods. The fine cuts (50-60 nm) were stained with uranylacetate and lead citrate and examined in EM JEM 100C at 80 kV. The fine structure of control sturgeon lymphocytes, plasma cells and macrophages completely corresponded to such ones of teleostei and mammals. Small lymphocytes were characterized by high nucleus: cytoplasm ratio. The cytoplasm was poor of organelles, it usually contained a few mitochondriae, small granules and isolated ribosomes (fig.1). Plasma cells were distinguished by the characteristic extensive rough endoplasmic reticulum (RER) cisternae (fig.2). Macrophages had lysosomes, mitochondriae, free ribosomes and phagocytic vacuoles in their cytoplasm (fig.3).



Figure 2. Plasma cell with extensive RER, control.

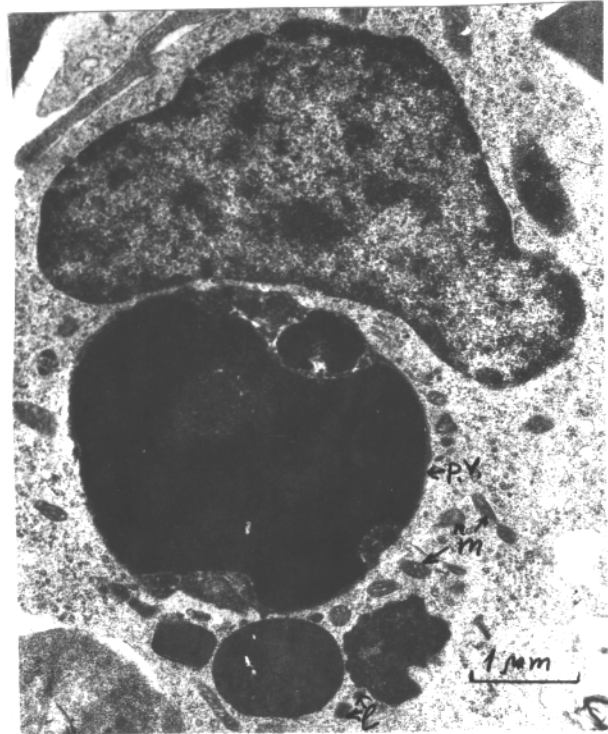


Figure 3. Macrophage with phagocytic vacuole (p.v.), lysosomes (l), mitochondriae (m.), control.

Two types of granulocytes - neutrophils and eosinophils - were observed in spleen and kidney of sturgeon. The fine structure of these cells corresponded to such one of teleostei. The neutrophils in cytoplasm had elongated and round granules, a few mitochondriae, free ribosomes and separate cisternae of RER (fig.4). The cytoplasm of eosinophils had large electrodense granules, a few mitochondriae and free ribosomes (fig.5).

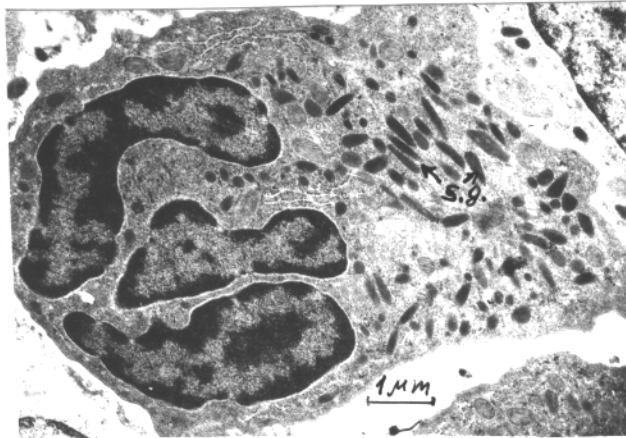


Figure 4. Neutrophil with specific granules (s.g.), control.

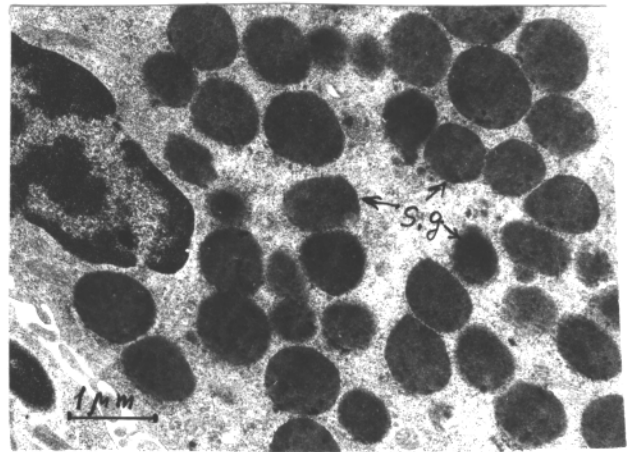


Figure 5. Eosinophil with specific granules (s.g.), control.

After 14 days of exposure to heavy metals one of cell organelles - mitochondria - were swollen, the part or all mitochondria cristae were destroyed in lymphocytes and plasma cells (fig.6,7).

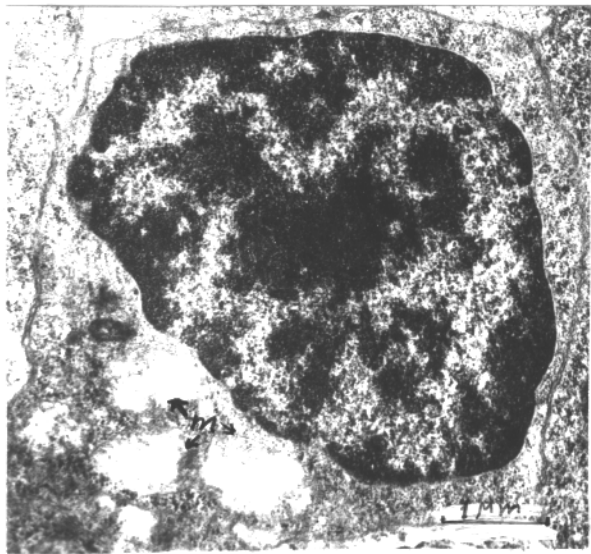


Figure 6. Small lymphocyte with degradate mitochondriae (m), 15 days of exposure to cooper.

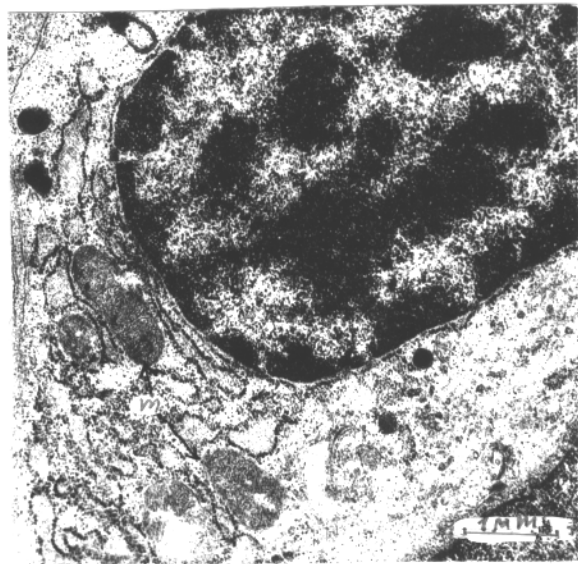


Figure 7. Plasma cell with swollen mitochondriae (m), 15 of exposure to mercury.

After 30 and 60 days destruction of mitochondriae observed also in neutrophils (fig.8) and eosinophils (fig.9). Moreover, the destruction of specific granules in eosinophils was noted.

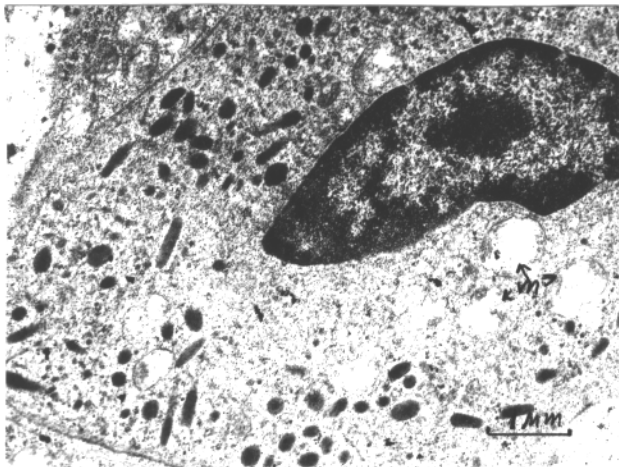


Figure 8. Neutrophil with degradate mitochondriae (m), 60 days of exposure to cadmium.

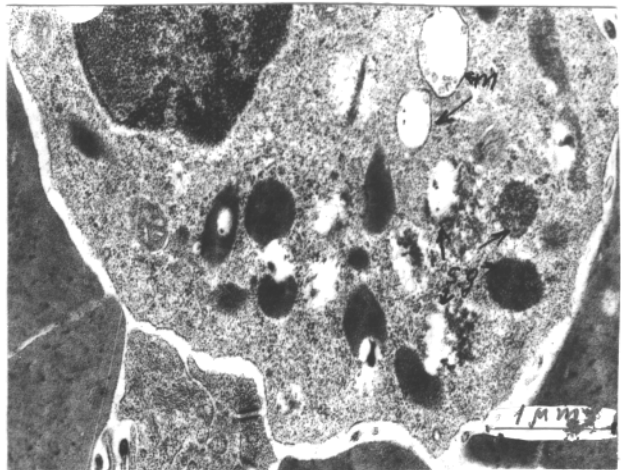


Figure 9. Eosinophil with degradate mitochondriae (m) and specific granules (s.g.), 60 days of exposure to mercury.

The mitochondriae are the most mobile structure of cell, and structural modification of these organelles in immunocompetent cells of sturgeons as affected by heavy metals may indicate unfortunate state of cells at conditions that not yet affected other cell structures.

References

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- Saxena MP, Gopal K, Jones W & Ray PK 1992 Immune response to *Aeromonas hydrophila* in cat fish (*Heteropmustus fossilis*) exposed to cadmium and hexachlorocyclohexane // *Bull. Environ. Contam. and Toxicol.* Vol.48, N 2, pp.194-201.