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A MORPHOLOGICAL STUDY ON BLOOD CELLS AND LYMPHOID TISSUES  
OF CARP (*CYPRINUS CARPIO*)

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The morphology of the blood cells and the lymphoid tissues of carp was investigated histologically and immunohistochemically.

Erythrocytes, thrombocytes, lymphocytes, granulocytes and monocytes were identified as peripheral blood cells in light and electron microscopical analysis. Lymphocytes were divided into small, medium and large lymphocytes. Some of the small and medium lymphocytes were  $\alpha$ -naphthyl-acetate-esterase-positive, while large lymphocytes were pyroninophilic. Granulocytes were classified into three types (I, II and III). Type I granulocytes possessed a lobed nucleus and a number of cytoplasmic granules, which were oval in shape and contained electron-dense material and crystalloid. Type II granulocytes had a small eccentric nucleus and were electron microscopically subdivided into IIa and IIb granulocytes. Granules of Type IIa granulocytes had an electron-dense rim, while those of Type IIb granulocytes contained electron-dense and lucent materials with a patchwork-like distribution. Type III granulocytes possessed a round nucleus and a few large granules, which were filled with regularly arranged fibriform materials and some needle-like structures.

In histological analysis, it was noted that the head kidney was a characteristic lympho-hematopoietic tissue. The parenchyma of the tissue consisted of well-developed capillary networks with various types of blood cells among them. Lymphocytes occasionally aggregated along the walls of the venules and capillaries. Marked lymphocyte infiltrations were observed in the mucous epithelia of the operculum cavity and the lamina propria of intestinal mucosae.

In immunohistochemical analysis after intraperitoneal injection of alum-precipitated bovine serum albumin (AP-BSA), the AP-BSA was observed in mesentery, kidney, spleen and thymus. The AP-BSA aggregated subsequently in clusters of pigment-containing cells in the kidney. Aggregations of large pyroninophilic lymphocytes were obviously observed next to the clusters. Specific-antibody containing cells against AP-BSA were scattered in the kidney and the thymus 7 days after the inoculation.

In the present study, it is suggested that the infiltration of many lymphocytes in the mucous of operculum cavity and a caudal part of intestine may functionally correspond to the tonsil and Peyer's patch of fowls and mammals. The immune responses in the kidney and thymus after AP-BSA treatment suggested that these organs may play an important role in the immune response of carp.