THE KIDNEY OF *Squalus acanthias* CONTAINS LYMPHOMYELOID TISSUE

Hartmut Hentschel[1], Marlies Elger[2]
[1] Max-Planck-Institut für molekulare Physiologie, Dortmund, FRG,
[2] Department of Nephrology, Medizinische Hochschule Hannover, FRG

Elasmobranch fish lack bone marrow and blood cell production is located in hemopoetic tissue outside the skeleton. Erythropoesis and thrombopoesis are thought to occur within the spleen, while leucocytes originate in special lymphomyeloid tissue of the esophagus (Leydig's organ) and the gonads (epigonal organ) (Fänge, R. and Pulsford, I. Cell Tissue Res. 230:337-351, 1983). Lymphomyeloid tissue has been observed in the kidney of archaic bony fish (holosteans and chondrosteans) and in the head kidney of teleosts (for review see Fänge, R. Fish Physiology, Vol. XIIB:1-54, 1992).

The definitive kidney of *Squalus acanthias*, the excretory portion of the opisthonephros, consists of glomerular nephrons, blood vessels, and an extended interstitial tissue. Two major zones of the renal tissue have been defined, the mesial tissue which is irrigated by venous blood of the renal portal system and the lateral bundle zone with an arterial blood supply via special bundle arteries (for review see Hentschel, H. et al. In: Ostrander, G. (ed), The Laboratory Fish, pp181-187, Academic Press, 2000; Elger, M. et al. In: Ostrander, G. (ed.), The Laboratory Fish, pp385-413, Academic Press, 2000). These renal components were represented in highly variable amount on histological sections, due to the complex three-dimensional organisation.

During microdissection of *Squalus* kidney, we observed that the superficial layer of lateral bundles frequently was covering deep furrows extending into the mesial tissue (Elger, M. and Hentschel, H. Bull MDIBL 32:23-27, 1993). Most likely, these furrows originate from growth processes, comparable to the formation of sulci in the developing and growing brain. Thus many histological sections revealed two bundle zones lying adjacently in the middle of the mesial tissue. The space between these bundle layers widened in the direction of the centre and the cleft was filled by cell-rich connective tissue. This tissue differed greatly from the collagen-rich connective tissue around the ureters at the ventral side of the kidney and beneath the renal capsule.

The aim of this study was to characterise the cell-rich renal connective tissue. Kidneys of adult female spiny dogfish were fixed by perfusion and studied by light- and electronmicroscopy. The cell-rich renal interstitial tissue is heterogeneous. It displays islands suggesting formation of red blood cells and nodule-like regions which are filled with leucocytes. A host of differentiated blood cell types can be observed in the vicinity of small capillaries (fig. 1). Among the cells a large amount of cells with basophilic cytoplasm is present. These presumably are precursor cells

in the blood cell lineage (blast cells). Also in this interstitial tissue there are zones where mesenchymal cells prevail. These zones are in contact with blind ends of the collecting duct system and the tissue contains various stages of developing nephrons (converted mesenchym in the process of epithelialization, s-shaped bodies) (see Hentschel H. et al., this bulletin). With the exception of these stages of nephroneogenesis, the cell-rich interstitial tissue of *Squalus* greatly resembles the lymphomyeloid tissue of the epigonal organ and the Leydig organ in *Scyliorhinus*.

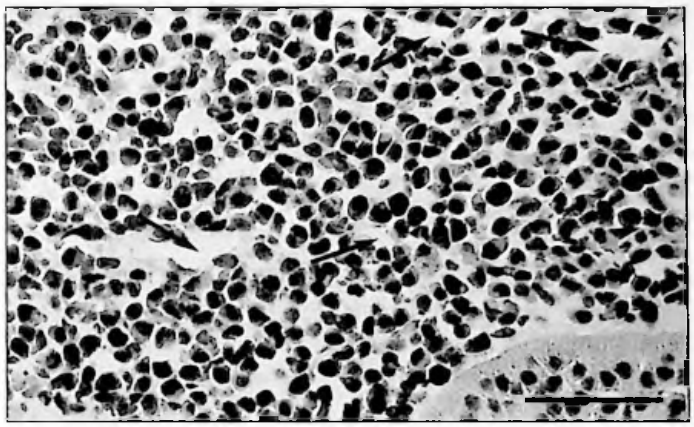

Fig. 1. Lymphomyeloid tissue in the kidney of *Squalus*. Arrows point to capillaries. Calibration bar equals 25µm.

A large number of the cells of the cell-rich connective tissue belong to the granulocyte cell type. Frequently these cells are round to ovoid cells with a compact, mostly excentrically located nucleus. The cytoplasm is filled by eosinophilic granules. A subset of the granulocyte population was labelled, when we performed controls for indirect immunohistochemistry by omitting the first antibody. Because many of the granulocytes of *Squalus* kidney reacted with immune-complex of the detection system (ABC, Vector Laboratories, Burlingame) they resembled eosinophilic granulocytes from the spleen and the Leydig organ of *Raja naevus*. Eosinophils of this skate have been shown to bind immune-complexes by surface receptors (Ellis A.E., J Fish Biol 11:453-491, 1977). At present the function of the different granulocytes in *Squalus* (and other fish) is not precisely known. It has been suggested that, besides from partaking in defence reactions against microbes and parasites, granulocytes may be important for growth and repair of fish tissues by releasing enzymes and other, unknown, substances (Fänge R. Fish Physiology, Vol. XIIB:1-54, 1992). As lymphomyeloid tissue is located in the kidney of Squalus in the immediate vicinity of developing stages of nephrons, a contribution to nephroneogenesis is most probable. With financial support by DFG.