Liver and Gallbladder Morphology of the juvenile Nile crocodile, *Crocodylus niloticus* (Laurenti, 1768)

by

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DECLARATION

I declare that the dissertation which I hereby submit for the degree MSc at the University of Pretoria is my own work and has not been submitted by me for a degree at another university.

To my husband Deon, for your support and patience

To my Pa, wish you were here....

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SUMMARY

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This investigation illustrates the topography, gross anatomy, histology and ultrastructure of the liver and gallbladder of the Nile crocodile in order to fill the gap that exists in the literature regarding this important crocodilian. For the topographical and macroscopical descriptions the livers and gallbladders were obtained from the carcasses of slaughtered juvenile Nile crocodiles. Perfusion and immersion fixation of tissues for histology and transmission electron microscopy were performed on juvenile Nile crocodiles donated to the university. Published descriptions of other vertebrates were inevitably relied upon for comparison due to the lack of information on these two organs of the Nile crocodile.

The liver was located in its own coelomic cavity with the post-pulmonary and the post-hepatic membranes intimately associated with the cranial and caudal surfaces of the bi-lobed liver respectively. The right lobe was larger than the left lobe and they were located at the level of the third to seventh intercostal spaces with their extremities extending to the ninth intercostal space. The triangular shaped liver lobes were joined dorso-medially by a narrow isthmus consisting of liver tissue. The liver was covered by Glisson's capsule.

Central veins, sinusoids and portal tracts were distributed haphazardly with no visible lobulation. The parenchymal component occupied the largest part of the liver and was formed by anastomosing and branching cell cords consisting of two-cell-thick plates in the longitudinal sectional plane and at least five hepatocytes in the cross-sectional plane. Central bile canaliculi contained microvilli originating from apical hepatocyte surfaces and were sealed off by junctional complexes. Hemosiderin granules, bile pigments, melanin pigments, lipid droplets, cholesterol ester slits and glycogen granules were observed in addition to the normal hepatic cytoplasmic organelles.

Non-parenchymal cells consisted of endothelial cells, Kupffer cells, stellate cells and pit cells localized in and around the angular sinusoids. The space of Disse existed between endothelial cells and the base of the hepatocytes which was lined by microvilli. Endothelial cells were flat cells with long fenestrated cytoplasmic extensions that lined the sinusoidal wall and contained numerous endocytotic vesicles and many lysosomes. Pleomorphic Kupffer cells were located in the sinusoidal lumen, in the space of Disse and within groups of hepatocytes. They were often situated between groups of hepatocytes, connecting two adjacent sinusoids. Large phagosomes were present in the Kupffer cells and contained a combination of melanin and hemosiderin granules as well as ceroid. Phagocytosis of apoptotic and dying cells was evident. Conspicuous groups of membrane-bound tubular organelles with a filamentous or crystalline interior were present in the Kupffer cells. Stellate cells occupied a subendothelial position in the space of Disse and contained prominent lipid droplets that indented the nuclei. A solitary cilium was infrequently found projecting into the space of Disse. Myofibroblastic cells were found in the same region as stellate cells. Pit cells with indented eccentric nuclei were found in the sinusoidal lumen and in close contact with endothelial and Kupffer cells. Numerous small electron-dense membrane-bound cytoplasmic granules were present. Occasional intercalated cells

resembling lymphocytes were seen in the space of Disse and forming part of the groups of hepatocytes.

Glisson's capsule extended collagenous trabeculae into the parenchymal interior and variably sized trabeculae randomly traversed the liver tissue. Portal tracts were enmeshed by a collagenous network that contained fibroblasts, lymphocytes, plasma cells and phagocytes. Portal triads consisted of branches of the portal vein, hepatic artery and bile duct with lymphatic vessels sometimes in accompaniment. Reticular fibres were positioned around hepatocyte tubules and a basal lamina supported the hepatocytes adjacent to Glisson's capsule. Occasional unmyelinated nerve axons were present. The isthmus contained liver tissue with similar parenchymal and a non-parenchymal components.

Three anatomical zones were identified in the pouch-like gallbladder that was attached caudally to the right liver lobe in the dorso-medial region. The gallbladder wall consisted of pseudostratified columnar epithelium, a *lamina propria,* a *muscularis externa* and a serosal layer. The accumulation of apical secretory granules, apical bulging, exocytosis of mucous granules and the desquamation of the apical portions of the epithelial cells into the lumen indicated different stages of the mucus secretory cycle.