7. SUMMARY

STUDIES ON THE ULTRASTRUCTURE OF THE ENCEPHALIC MENINGES OF THE DOMESTIC FOWL (GALLUS GALLUS DOMESTICUS)

In order to clarify their ultrastructure, the meninges encephali of 34 domestic fowls were examined. The male and female specimens were aged between 3 months and two years. The electron microscopic techniques were complemented by lanthan nitrate staining and immunocytological diagnosis of intermediate filaments of the vimentin type.

The results provide an overview of the ultrastructural morphology of all parts of the meninges of the domestic fowl and their participation in the Pacchionian granulation formation:

The densely vascularised pia mater is connected to the underlying basement membrane of the brain by the intima piae. Peripherally, it lies adjacent to the arachnoid membrane which consists of three elements: the subarachnoid space, the loose arachnoid reticular layer, and the compact, epithelium-like arachnoid barrier layer. All of the three elements of the arachnoidal layers take part in the Pacchionian granulation formation.

The subarachnoid space is coated with a continuous epithelial-like layer of fibrocytes. This cellular coating also covers passing collagenous fibres, blood vessels and nerves. Beside fibrocytes, numerous lymphocytes and macrophages can be detected in the subarachnoid space. The arachnoid reticular layer is separated from the arachnoid barrier layer by a discontinuous basement membrane. The arachnoid barrier is a multilayer formed by closely adhering cells. Its innermost cells are connected by desmosomes and gap junctions, whereas the outermost layers possess many tight-junctions. The lanthan nitrate staining confirms the barrier function of the arachnoid barrier layer. Its cells are characterised by a high amount of intermediate filaments of the vimentin type. A very distinct intercellular space between the arachnoid barrier layer and the neurothelium was demonstrated. It contains a lot of electron dense amorphous material. Lanthan nitrate staining proved that no tight junctions seal off the intercellular space between the arachnoid barrier layer and the neurothelium.

The adjacent subdural neurothelium consists of two to four cell layers of long and flat cuboidal cells connected by desmosomes and gap junctions. Their cytoplasm does not react with the monoclonal antibody against vimentin.

In the regions of the dorsal sagittal sinus, the olfactorial sinus and the dorsorostral cerebral veins, the firm connective tissue layer of the dura mater is locally disrupted by the Pacchionian granulations. The subarachnoid space forms the centre of the granulation, whereas the arachnoid reticular layer, the arachnoid barrier layer and the neurothelium participate in forming the external layers of the granulation. In the granulations, the intercellular space between arachnoid barrier layer and neurothelium is not as distinct as demonstrated in other parts of the leptomeninx. In some specimens, the core of the granulations is infiltrated with numerous lymphocytes, thus making a clear differentiation of the different tissue layers difficult.

The sinoidal endothelium covers the surface of the granulation, which usually float freely in the blood-filled lumen of the sinus. However, in one of the specimens, the granulation penetrates the opposite wall of the sinus and grows inwards, towards the outermost part of the dura mater.

The results of the scanning and transmission electron microscopic examination of the surface of the granulations suggest a possible liquor resorption via the Pacchionian granulations.
The species-specific peculiarities of some of the leptomeningeal regions, particularly of the arachnoid barrier layer, the subarachnoid space and the neurothelium, are compared to the conditions in mammalian domestic animals and man. Furthermore, the structure of the surface of the granulations is discussed regarding a possible liquor absorption.