III. Summary

Effect of reduced environmental oxygen content on the development of the myocardium in chick embryos (Gallus gallus f. domestica)

- an immuno-histochemical, lectin-histochemical and morphometric study -

A multitude of studies support the view that the chick embryo - developing within the egg - is endowed with a high tolerance for oxygen deficiency conditions. This tolerance results from the various adaptive abilities of the embryonic organism. Complementing the physiologic studies of DECKER (2002) and DZIALOWSKI (2002), the present morphologic study rendered new insights into the effect of incubation under reduced environmental oxygen content on the development of the embryonic heart, particularly regarding its cellular and structural components.

While developing from a mesoderm-derived tube-like organ to a four-chambered organ, the embryonic heart – complying with the growing embryo's needs - displays an increased contractive force as well as alterations in function and effectiveness. A like-wise 'increased efficiency' of the heart is potentially needed under reduced environmental oxygen content and requires qualitative alterations of the cardiac cells, such as differences in the degree of differentiation. It might also induce quantitative alterations within the contracting syncytic cardiomyocytes, i.e. proliferation. The morphometric examination of this study showed that quantitative alterations prevailed within the adaptive mechanisms of the heart. The chick embryos incubated under reduced environmental oxygen content displayed an increase of the mean value cell count regarding three different locations within the heart (left ventricle, interventricular septum, and right ventricle) compared to the respective localisations within the control group. Although these results were only significant for the interventricular septum, they indicate that the reduced environmental oxygen content indeed effects the structural development and differentiation of the embryonic myocardium. This adaptive mechanism results presumably from a "reactive" hyperplasia of the cells, as well as from an increased mitotic myocardiac activity during a "sensitive phase" of the chick embryo between the sixth and twelfths day of incubation, respectively. This adaptive potential - like other parameters described in the literature - is detected only temporary, during a distinct developmental stage. The hearts of older chicks shortly before hatching of both, test and control groups, displayed nearly identical mean value cell counts within the selected localisations of the myocardium. Thus, the detected altered morphologic parameter within the test group was balanced towards the end of the prenatal development. The immuno- and lectin-histochemical examination of

the hearts - carried out in order to document qualitative adaptations, and differences in the degree of myocardiac differentiation within the working myocard of the chick embryo, respectively - displayed no differences between the test groups. However, age-related reactivity patterns of different antibodies and lectins were detected in the embryonic chick heart. Thus, the immuno-histochemical characterisation displayed differences between the differentiation of the myocardiocytes and the smooth muscle cells of the heart vessels. The results of the light microscopic examination of the present study mainly confirmed the data described in the literature on the configuration of the myocardiac tissue in the chick embryo. Light microscopy of the developing embryonic heart from different age groups revealed age-related structural alterations within the myocardium.