

# MICROBIOLOGY AND IMMUNOLOGY

## PATHOLOGICAL CHANGES IN THE TISSUES OF THE CHICK EMBRYO AT VARIOUS AGES CAUSED BY THE ACTION OF A VIRUS

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It has been shown previously that the cytopathological changes in cultures of three tissues from chick embryos of different ages, caused by the virus of Newcastle disease, are all of one kind and appear as eosinophilous cytoplasmic inclusions.

The present work deals with a study of the nature of the cell reaction and the pathological changes evoked in chick embryo tissues of different ages as a result of virus infection.

### METHODS

Chick embryos (Russian White breed) of 9, 13, and 16 days of incubation (stages 32-35, 37-38, 41-42 [3]) were used in these researches; they were inoculated with Newcastle virus strain B-1 which is virulent towards embryos. The titer of the virus, determined from 8 day embryos was found to be equivalent to  $10^{7.5}$ ,  $10^8$  I. U. (infection units) per 0.2 ml. A dose of  $10^5$ - $5 \cdot 10^6$  I. U. per 0.2 ml introduced into the allantoic cavity was used to infect the embryos with virus.

The liver, kidneys, and lungs were used as organs for investigation. The material was fixed in Bouin's fluid or by Shabadash's technique. Transverse and sagittal sections of thickness 5-7  $\mu$  were cut and stained with Mayer's hematoxylin and eosin.

### RESULTS

The virus reproduced itself and invoked pathological changes in all three organs; it accumulated in amounts sufficient to give a considerable titer 4 days after injection.

Sensitivity towards the virus was highest in young embryos (9, 13 days incubation). In these groups the virus proved lethal after 4 days in 20.5% and 9% of cases respectively, whereas in embryos of 16 days incubation the lethal rate was only 3.5-5%. At the same time we were able to demonstrate that embryos in stages 41-42 exhibited no pathological changes, directly attributable to virus action, in their cells.

In earlier stages of development (32-35 and 37-38) we noticed cytoplasmic eosinophilous inclusions in the cells of the collecting ducts and the kidney capsules 3-4 days after infection; these inclusions also occurred in the parenchyma cells of the liver (Figs. 1 and 2). Later, basophilous, intranuclear inclusions were also found to occur. Neither of the two types of inclusions were found in control sections.

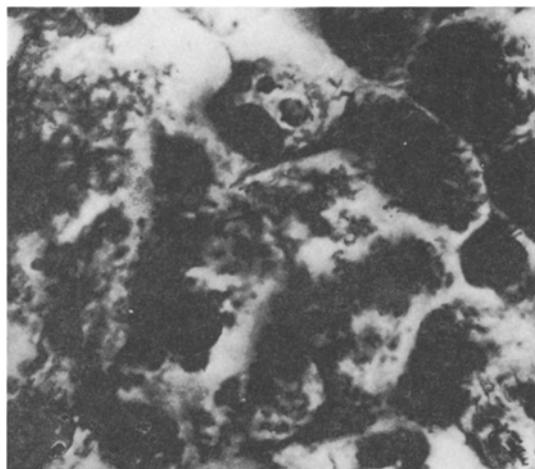


Fig. 1. Liver of chick embryo of 14 days incubation and on the 5th day after infection. Cytoplasmic inclusions. Microphotograph. Stained hematoxylin-eosin. Magnification  $\times 1400$ .

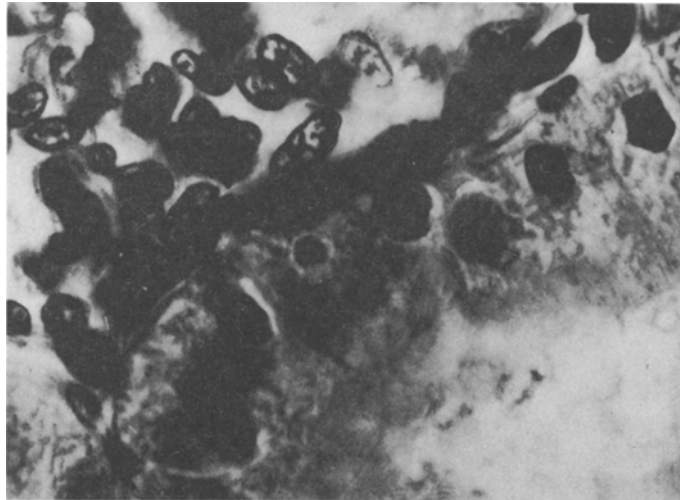


Fig. 2. Kidney of chick embryo of 14 days incubation and on the 5th day after injection. Inclusions in the cells of the collecting ducts. Microphotograph. Stained hematoxylin-eosin. Magnification  $\times 1400$ .

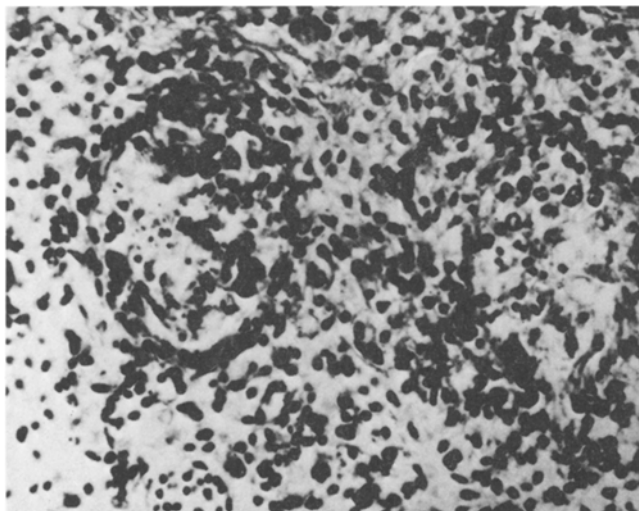


Fig. 3. Lung of chick embryo of 15 days incubation on the 6th day after infection with virus. Degenerative changes in the lung tissue. Microphotograph. Stained hematoxylin-eosin. Magnification  $\times 500$ .

The eosinophilous inclusions in the kidneys were rather large and appeared to be optically denser than those in the liver cells.

Erythroblasts with large granules to their cytoplasm appeared in the liver and in the cavities of its ducts. This granulation increased as the embryo became inflated and ultimately died. The various consecutive changes in this process could be followed quite readily. It was usual for the erythroblasts to be in contact with the infected cells. When they occurred in lung tissue no inclusions could be seen in them, either at this or subsequent stages of development.

Preparations of all organs from the fourth day onwards showed a general picture of chromatolysis and pycnosis of the nucleus. Despite the presence of such pathological changes in the cells, normal mitoses could be observed in all the organs studied. More complete degeneration of the cells, involving the formation of large necrotic patches and considerable inflammation, was noticeable at a later period of time (4-6 days) after injection of the virus; these changes were particularly characteristic of lung tissue (Fig. 3). Such non-specific degeneration was associated with all stages studied.

We have noticed considerable individual sensitivity to the virus in the course of our experiments. This is expressed by the fact that at the same time as certain embryos were showing irreversible pathological changes, other embryos merely exhibited the initial signs of infection.

Experimental data indicates that embryos are most sensitive to the effect of the virus during their early stages of development i.e., during the period of morphogenesis [1, 2, 5]. The teratological effect of the virus is associated with regions of high metabolic activity, and it is in such cases that the specificity of the tissue tropism is less acutely expressed [4]. Specific tissue susceptibility occurs later in development during the period when the functional activity of the organs is beginning to manifest itself. In these later stages, during the period of almost complete functional maturity, the infection becomes generalized and is dissimilar, even with respect to its tissue tropism, to the infection in adult animals. This final state of affairs is often accompanied by a reduction in the lethal nature of the infection.

In describing pathological changes in tissues it is important not to exclude the factor of toxicity, especially where a large dose of virus is involved.

The development of age resistance to the virus by the embryonic cells appears to be related to the emergence of an inflammatory reaction and to a whole series of little-understood factors of cellular and humoral resistance.

It can be concluded, on the basis of previous data regarding the monotypic reaction of cells belonging to different tissues to virus infection and also on the basis of this present work, that the response reaction of cells undergoes considerable changes during their cultivation within the organism and there is a trend towards unification of their properties.

#### LITERATURE CITED

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