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Microincineration of Degenerating Anterior Horn Cells in Experimental Poliomyelitis.*

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The literature concerned with poliomyelitis seems to be largely composed of results of studies on the more general and gross pathological aspects of the disease. Another line of investigation has been opened up by Marinesco, Policard and Cowdry which begins with the cell rather than the symptom. As yet, no such approach has been made toward the understanding of poliomyelitis. The present paper deals with but a single phase of the cytopathology of the disease—the changes in inorganic constitution as determined by the microincineration method.

The material was obtained from autopsies of 43 monkeys *(Macacus rhesus)* experimentally infected with poliomyelitis by the intracerebral and intranasal routes. The tissues were fixed in absolute alcohol formalin and prepared for incineration according to the method described by Scott.[1] Alternate serial sections were incinerated or were stained with hematoxylin and eosin in such a manner that colored and ashed preparations of the same cell were available for comparison. For controls, similarly prepared material from 10 normal monkeys or monkeys dying of diseases other than poliomyelitis was used.

The normal anterior horn cell incinerated under optimum conditions leaves a characteristic and uniform ash. The cytoplasm is represented by a very finely divided, mist-like, bluish or whitish ash. Against this filmy background spots of somewhat denser whitish, powdery material may usually be seen, evidently representing the Nissl bodies. The nucleus appears as a hole in the cell, set here and there with refractile granules, sometimes yellowish, but more often white, which may be identified as the chromatin substance. The mineral residue of the nucleolus is seen as a flat white, finely granular material of varying intensity.

In the spinal cord of a monkey inoculated with poliomyelitis virus,

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[1] Scott, G. H., *Protoplasma*, 1933, **20**, 133.

several forms of degenerating cells may be seen. Three typical pictures will be described here:

1. During the early stages of degeneration the cell becomes somewhat swollen, the Nissl bodies are lost and the cytoplasm tends to take a lighter stain. The nucleus is often enlarged and may occupy an excentric position in the cell body. The basophilic chromatin material appears bead-like or as irregular masses scattered about within the nucleus or plastered to the nuclear membrane. It is in such cells that the nuclear inclusions described by Covell[2] and Hurst[3] may be seen. Incinerations of these cells show that they contain slightly less mineral matter than the normal neurone. The Nissl substance does not appear. Although the inclusion bodies are too small to be identified in consecutive sections, they seem to leave a very slight ash.

2. In more severely injured cells the cytoplasm becomes filled with basophilic granules. These are scattered about within the cell or may be localized in one portion. They are globular in shape and vary in staining properties from a deep blue to a dense black. The nucleus is homogeneous, hyperchromatic and shrunken. The incinerated preparation of such a cell is indeed striking. It is characterized by a dense white, refractile, granular cytoplasmic ash which seems to be piled on the slide. This enormous increase in mineral matter is shared by the processes, which appear as glistening streaks in the gray matter of the cord. The nucleus, in spite of its marked increase in stainable substance leaves a very light ash, in which a mass of mineral matter resembling that left by the nucleolus may sometimes be seen.

3. The cytoplasm of the completely necrotic cell appears as a spongy acidophilic material, usually containing a round, acidophilic, hyaline body which represents the nucleus. Such a cell when incinerated leaves a net-like or granular ash which is somewhat heavier than that left by a normal cell. The hyaline nucleus leaves no mineral residue whatever.

Neuronophagia may take place during either of the 2 last described stages. In either case the cytoplasm of the neuronophages takes on the staining properties of the phagocytized cell, *i. e.*, it may contain basophilic granules or may exhibit the acidophilic staining properties of the necrotic cell. The ash of the neuronophagic focus resembles that of the degenerating cell except that it is dotted with

[2] Covell, W. P., PROC. SOC. EXP. BIOL. AND MED., 1929, **27**, 927.

[3] Hurst, E. W., *J. Path. and Bact.*, 1929, **32**, 457.

the nuclei of the phagocytes. The granular cells, after incineration leave the characteristic heavy refractile deposit, while the acidophilic cells are represented by a white net-like ash. It would seem that little or no change in inorganic material takes place during neuronophagia, the entire mineral content of the degenerating cell being taken over by the phagocytes.