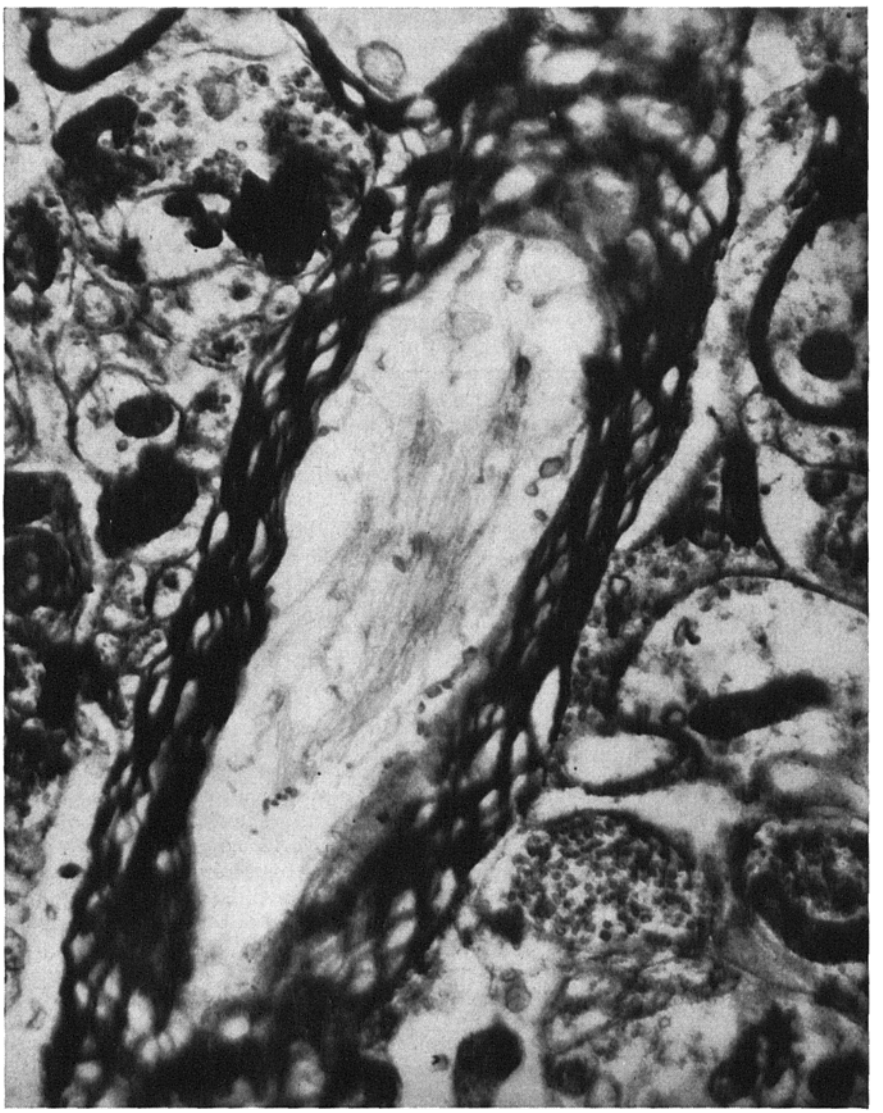

Dislocation of myelin lamellae in a thick neurofibre of the caudate nucleus 7 days after experimental cervical lymph blockage in the rat. × 32,000.

sheath, they became dislocated, resulting in a curly appearance (Figure).

It should be stressed that similar alterations were described by LEE and BAKAY[10] as a typical ultrastructural change for the œdematous CNS.

Zusammenfassung. Bei der durch Unterbindung der zervikalen Lymphbahnen herbeigeführten experimentellen lymphogenen Encephalopathie der Ratte konnte eine schwere Desintegration der Myelinstruktur – eine für ein Hirnoedem charakteristische Veränderung – nachgewiesen werden.

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Mast Cells in Nerves Affected with Fowl Paralysis (Marek's Disease)

This communication records the occurrence and variation in numbers of endoneurial mast cells in the sciatic nerves of normal and fowl paralysis-affected Brown Leghorn hens. Fowl paralysis is a disease of the peripheral nerves of *Gallus domesticus*[1]. It is world-wide in distribution and causes considerable economic loss. WIGHT[2] suggested that the nerve lesions could be classified in 3 main histopathological types; the predominant feature of type I is neural infiltration by mature lymphocytes and some plasma cells, type II is characterized by interneurite oedema and a relatively sparse infiltration of mature lymphocytes and plasma cells, while the nerves in type III are massively invaded by primitive lymphoid cells which have many neoplastic characteristics.

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The sciatic nerves were removed from 4 groups of 10 birds each, 1 group being normal while each of the other groups was affected with fowl paralysis of 1 of the 3 morphological types. The nerves were first fixed in 10% formol-saline, then in Susa and 5 μ thick paraffin sections were stained by the acridine orange method of JAGATIC and WEISKOPF[3]. The number of mast cells in a 1 cm long section of the same region of each nerve was counted at a magnification of 400 diameters, illumination being blue fluorescent light of 400 nm wave-length generated by a 200 Watt UV source.

From the Table it can be seen that endoneurial mast cells were present in the nerves from normal hens and that their numbers were not appreciably altered in fowl paralysis of type I. In the majority of nerves of type II there were considerably more mast cells (Figure 1) than in the controls; in 8 of the 10 cases the number counted in the standard length of section lay outside and above the range observed in the controls. Many of these mast cells showed discharged granules. By contrast, the number of mast cells was usually much reduced in nerves with lesions of type III; in all except 2 cases the number observed lay outside and below the range of the controls. By decolourizing and restaining with toluidine blue, it was shown that the fluorescent cells displayed the metachromasia typical of mast cells. Electron miscroscopic examination showed (Figure 2) various stages in the maturation of the granules[4], which indicates that they are true mast cells and not macrophages containing ingested metachromatic and fluorescent material. One case of type III had exceptionally large numbers of mast cells, although these differed from those of both the control and other affected birds in being smaller and having only a narrow rim of fluorescent cytoplasm.

Mast cells have been located in many mammalian organs, including the endoneurium of normal nerves[5–8], and it has been shown that their numbers increase in experimentally transected mammalian nerves[6–10]. Mast cells also occur in birds, but so far as the author can determine, their presence in normal tissue has hitherto been recorded only in s.c. tissue[11] and comb[12]. Under pathological conditions tissue mast cells or basophils accumulate around Rous sarcoma experimentally induced in the chick[13,14].

The present study shows that mast cells not only occur in normal avian nerves but are proliferated in one type of spontaneous avian neuritis. It has previously been shown[2] that this type (II) of fowl paralysis is characterized by oedema which often has a fibrinous or granular appearance. This material satisfies the histochemical criteria[15] for mucopolysaccharides; it is metachromatic, and gives positive reactions with Hale's colloidal iron and Alcian blue. The amount of perineurite collagen may also be much increased. This combination of findings is particularly interesting in the light of the known and suspected functions of the mammalian mast cell. These cells may (cf. SELYE[16]) produce heparin, histamine, hyaluronic acid, 5-hydroxytryptamine and mucin, and they may have a

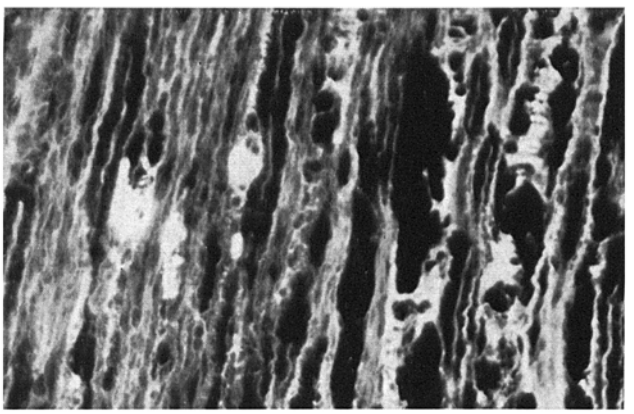

Fig. 1. Fluorescent endoneurial mast cells in a sciatic nerve affected with fowl paralysis. Fluorescent mucopolysaccharide material can also be seen between the neurites on the right side of the illustration. × 275.

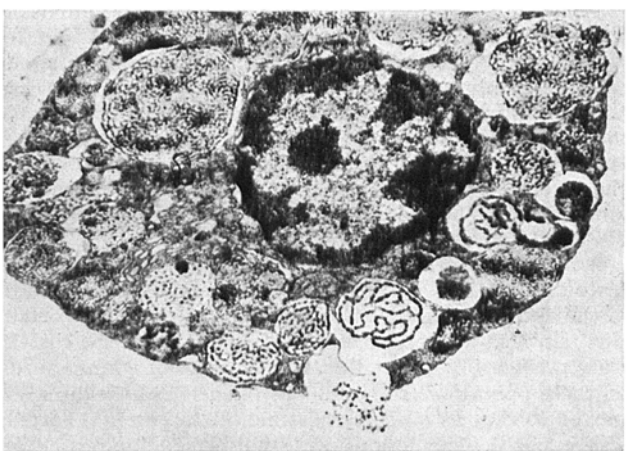

Fig. 2. Electron-microscope photograph of an endoneurial mast cell from a fowl paralysis-affected sciatic nerve. Granules are present and some appear to be discharging from the cytoplasm. × 13,000.

Numbers of mast cells in 1 cm longitudinal sections of control and fowl paralysis-affected Sciatic nerves

Control nerves	Fowl paralysis nerves		
	Type I	Type II	Type III
168	48	429	61
210	234	411	3
210	210	334	1327
188	151	353	6
191	236	655	40
225	265	568	0
175	58	934	215
171	178	171	20
134	205	609	57
234	210	100	48

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role in the local fixation of blood-borne materials in immunological and anaphylactic reactions. They are numerous in sites of chronic inflammation. It is thought that degranulation and liberation of histamine from mast cells under the influence of local stress may help to bring about an inflammatory oedema; after nerve section the histamine content rises[17] and there is a correlation between the increases in serotonin level and the number of mast cells[9].

The reduction in numbers of mast cells in fowl paralsisy of type III may be due to their obliteration by invading lymphoblasts in the same way as these cell masses have been shown to destroy large numbers of the neurites[18]. No increase in mast cells was noted in adjacent tissues although their response as a defence against tumorigenesis in mammals[16] and against the Rous sarcoma of birds[13,14] has been reported.

Zusammenfassung. Bei der spontanen Marekschen Hühnerlähmung, die durch Ödembildung und Ablagerung von Mucopolysacchariden und Collagen zwischen den Nervenfasern gekennzeichnet ist, erhöht sich auch die Anzahl der Mastzellen bedeutend. Es zeigt sich, dass Nerven, die eine neoplastische Infiltration mit primitiven lymphoiden Zellen aufweisen, weniger Mastzellen als gesunde enthalten. Zur Identifizierung der Mastzellen wurde auch das Elektronenmikroskop verwendet.

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Monoamine Pathways to the Cerebellum and Cerebral Cortex

From previous work[1] it is known that the noradrenaline (NA) and 5-hydroxytryptamine (5-HT) nerve terminals of the rat cerebral cortex derive from axons which originate from NA and 5-HT cell bodies in the lower brain stem and ascend mainly in the medial forebrain bundle. After axotomy retrograde changes occur in those cell bodies and monoamines accumulate in the neuron proximal to the lesion[2,3]. Using these principles the effect of removal of the cerebral cortex and cerebellum on the central monoamine neurons has been studied with the help of the histochemical fluorescence method[4,5].

Adult male Sprague-Dawley rats were used both in the histochemical and biochemical experiments. In about half of the animals used for histochemistry the cerebral cortex was removed uni- or bilaterally. In some cases the cortex was transversely cut at the level of anterior commissure. In these operations the scull was opened and the dura removed so that as much as possible of the cerebral cortex was exposed. The lesions were performed by means of suction with a fine glass cannula. In the other animals taken for histochemistry as much as possible of the cerebellum was removed in an analogous way. All operations were performed in ether anaesthesia. At different time-intervals after the operation the animals were killed by decapitation under light chloroform anaesthesia. The various parts of the brain were dissected out, freeze-dried, treated with formaldehyde gas for 1 h, embedded, mounted and examined as described previously[6,7].

In the biochemical experiments the concentration of NA and 5-HT in the cerebellum, the cerebral cortex, the amygdala and the hippocampus were determined spectrophotofluorimetrically after cation exchange chromatography[8-10].

Removal of cerebral cortex. Usually more than $^2/_3$ of the cortex were removed. In most cases the basal layers were preserved. At all time-intervals (1–5 days) studied there was a marked accumulation of NA and 5-HT in axons running fronto-occipitally in the cingulum frontal but not occipital to the place of the lesion (Figure 1). The axons could be traced frontal for several mm and were seen to enter the cingulum just frontal to the septal area.

The axons were very thin and appeared to be unmyelinated. In no case did monoamine-containing cell bodies appear in the remaining parts of the cortex. Sometimes the damage penetrated also into the subcortical structures. In these cases an accumulation of catecholamines (CA) and 5-HT, respectively, was observed in a large number of axons in the striae terminalis, the dorsal fornix, and the fimbriae hippocampi frontal to the lesion. These axons normally innervate the amygdala and the hippocampus, which were found to contain rather high levels of NA and 5-HT (Table) or between 5 and 15% of the total content of these amines in the entire brain. In those cases where the gyrus cinguli remained intact, an increased number of NA nerve terminals with an increased intensity were observed in this area. Retrograde cell body changes with inter alia a swollen appearance and a marked increased fluorescence intensity occurred in CA nerve cells in the ventro-lateral part of the reticular formation of the medulla oblongata (group A1 according to DAHLSTRÖM and FUXE 1964) (Figure 2). However, only part of the cell group (about 20%) was affected. Certain increases in fluorescence intensity were also observed in a small number of CA cell bodies of the pons whereas no certain increases could be seen in the mesencephalic CA

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