PRELIMINARY NOTE ON THE MAST CELLS OF THE HUMAN PITUITARY AND OF THE MAMMALIAN PITUITARY IN GENERAL

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It was stated by Kohn in 1910 (1) that the pars nervosa of the pituitary body of many Mammals, particularly of cattle, contains large numbers of mast cells, although in Man they are very few and scattered in this organ. Kohn did not extend his observations further on this point, and later writers merely requote Kohn's statement if they mention the subject at all.

The present finding of an abundance of these cells in the pars nervosa and infundibulum of Man, the cat, and the ox was made by the use of eosin-methylene blue stain prepared by the Romanowsky methods (particularly Hasting's account of the Nocht-Romanowsky stain described by de Beer (2)).

In view of the abundance and very general presence of these cells as far as my investigations have proceeded, and of their striking relation to the blood vessels particularly of the infundibulum, and of the absence of accurate records of these cells in relation to that much discussed organ the pituitary, I have prepared this preliminary report while further investigation is proceeding.

The stain may be used on paraffin-embedded tissues fixed by any of the ordinary methods. All my material, except that from Man and from the ox, has been fixed by intracardiac injection of 10 per cent. neutral formalin in normal saline during ether anaesthesia; and the pituitary and hypothalamus were then removed immediately by chipping away the sphenoid bone.

As de Beer states, unless the sections and the stain are strictly neutral the double staining is not obtained. Only the eosin takes if the reaction is acid, while only the methylene blue takes if there is alkalinity of the dye, or the sections, or the alcohol, xylol or balsam used in the course of staining. To counteract this difficulty one could obviously neutralise the sections immediately before staining by giving them an acid or alkaline bath (the requisite being found by preliminary staining of one slide from a batch). The stain is made up in methyl alcohol as solvent, and, since the differentiation is done in 95 per cent. alcohol, it was soon found that acid alcohol (1 per cent. HCl in absolute alcohol) or alkalinised alcohol was the best and simplest neutralising agent for the sections. This saved taking the sections through successive alcohol dilutions before and after their neutralising bath.

The stain might almost be called a specific for mast cells, especially when examining an organ like the pars nervosa of the pituitary. The cells stand out clearly distinguishable from all others even to the eye of a tyro.

THE CHARACTER OF THE CELLS

The ordinary details of appearance and structure can be seen from the accompanying sketch figures in which one is struck by these fairly large cells with definite nucleus, cytoplasm more or less densely filled with coarse basophile or more accurately purple metachromatic granules, and cell outlines either rounded or showing protoplasmic processes or stretched out into a long spindle near a capillary.

The differences in the appearances from all other types of cell and from pigment masses in the pituitary can be readily seen from the figures, though the differences were even more obvious to the eye in examining the stained sections. Intracellular and extracellular pigment in the pituitary occurs as granules or globules that vary much in size and are stained a green colour by the stain here used—indicating a weak affinity for the methylene blue, which is extracted and modified in colour to a much greater degree by the alcohol than is the same dye when taken on by nuclei or by true basophilic granules.

Except in the cat I found it almost impossible to identify the mast cells in sections stained with ordinary haematoxylin and eosin.

OCCURRENCE IN CATTLE

In the ox these cells occur as rounded ovoid cells scattered throughout the pars nervosa, being most numerous near the junction with the pars intermedia. Altogether one may see as many as fifty in any section in the pars nervosa. In the pars intermedia they are to be found in smaller numbers lying chiefly in the fibrous trabeculae close to small blood vessels in the trabeculae of this region. Here they are not rounded as in the pars nervosa, but are generally flattened, and often possess pseudopodia which are rendered visible by the granules in them. No mast cells were seen in the pars anterior. Unfortunately none of the ox pituitary specimens I have been able to obtain so far have the infundibulum present.

OCCURRENCE IN THE CAT

In the cat these cells show up best in adult specimens, although in a specimen taken from a female kitten aged about 3 months they are present in moderate number. Their distribution in the cat's pituitary is shown in fig. 1, and it is in sections from this animal that one can see very well their peculiar relationship to the capillaries and commencing venules (see fig. 2). The appearances strongly suggest that these cells are wandering about freely in small numbers in the pars nervosa, and that in the infundibulum they are congregated and "on the move" in the direction of the long axis of the hypophysial stalk, becoming spread out in apposition to a capillary wall whenever such a structure is reached. So far I have not found them inside the lumen of a capillary nor in the hypothalamus. The capillaries to which the mast cells become related are apparently the capillary arches of the pituitary stalk described by M. A. Basir (3) in the dog, or in other words the primary net of

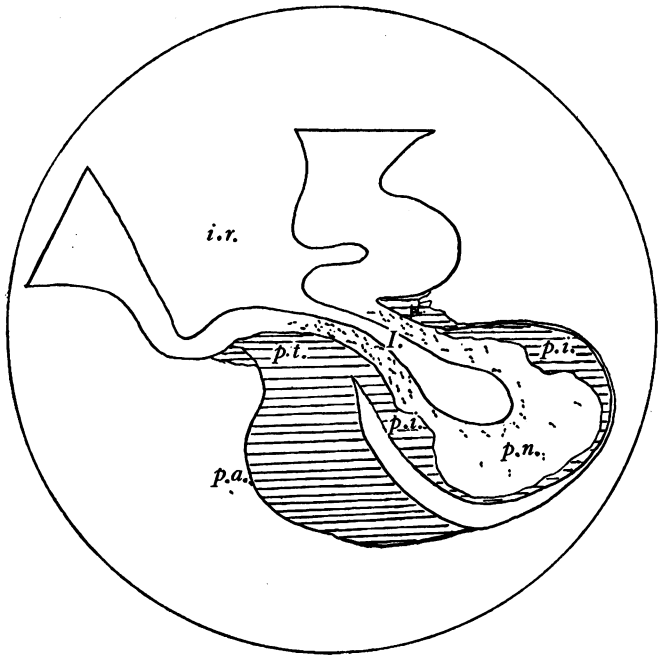

Fig. 1. Small paired dots indicate distribution of mast cells in the cat's pituitary. *p.a.*=pars anterior; *p.t.*=pars tuberalis; *p.i.*=pars intermedia; *p.n.*=pars nervosa; *I.*=infundibular canal; *i.r.*=infundibular recess of third ventricle. The number of paired dots indicates approximately the number of cells per section.

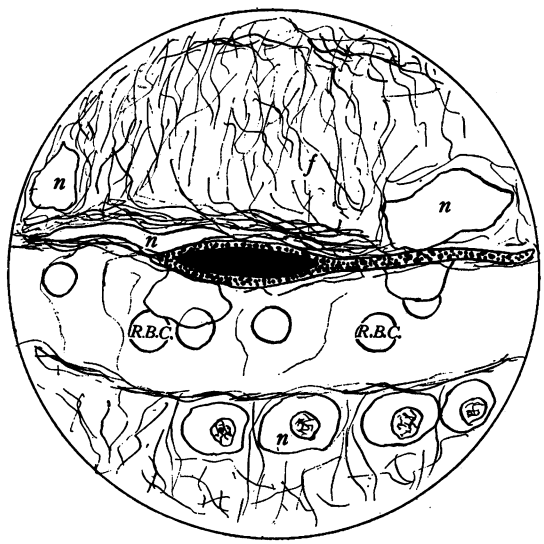

Fig. 2. Portion of infundibulum of cat's pituitary. Mast cell spread along a capillary wall. *n.*=neuroglia cell; *f.*=neuroglial network; *R.B.C.*=red blood corpuscle.

Popa and Fielding's hypophysio-portal system (4). So far I have not seen any mast cells near the secondary net under the ependyma of the recessus infundibularis of the third ventricle.

Their total distribution and relative numbers in the cat's pituitary are shown in the diagram (fig. 1) representing the picture near the median sagittal plane.

I have not found them in the pars intermedia, tuberalis or anterior of the cat's pituitary.

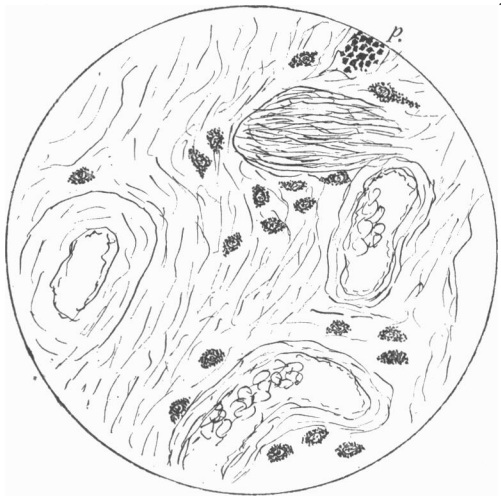

Fig. 3.

Fig. 4.

Fig. 3. Portion of infundibulum of human pituitary. Thick section, 12 μ, showing frequency of mast cells at the area where they are most numerous. *p.* = mass of pigment granules.

Fig. 4. Infundibular region of human pituitary. Showing three mast cells. Note the central one on the move, and the lower one adjacent to a capillary. *cap.* = capillary.

OCCURRENCE IN MAN

My observations so far indicate that the mast cell is almost as frequent in the human pituitary as in that of other Mammals. They are most numerous in the infundibulum, where one finds them chiefly in the fibrous and neuroglial tissue in the neighbourhood of the larger arterioles and venules of the infundibulum (see fig. 3). They are also present scattered about near the squamous epithelial nests described by Kiyono (5) in the human pars tuberalis and infundibulum.

In Man the mast cell also occurs scattered throughout the whole of the infundibulum in much smaller number than near the larger blood vessels (see fig. 4), and many of those lying apart from the vessels present the same

appearance of being "on the move" as is seen in the cat. A few can be found in the pars nervosa, and one or two in most sections of the pars anterior near its upper part towards the infundibular region (see fig. 5).

Using the methylene blue-eosin staining one can readily distinguish the mast cells from pigment masses (see fig. 5), from colloid masses, and from the granular bodies described by Herring (6). So far I have not been able clearly to identify in my sections the granular masses with degenerating nuclear fragments described by Cushing and Goetsch (7). But the characters of the cells described in this article leave no doubt in one's mind that they are normal

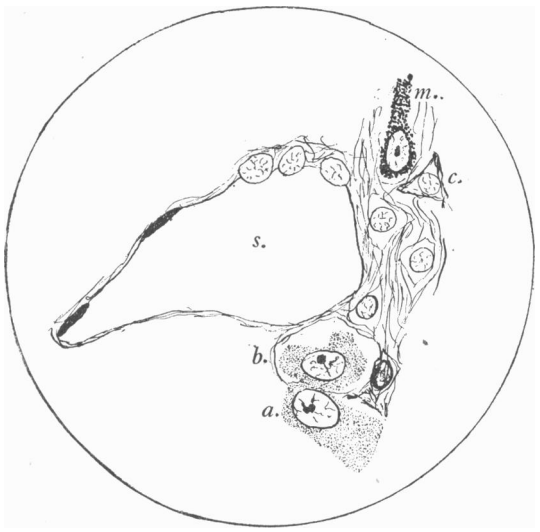

Fig. 5.

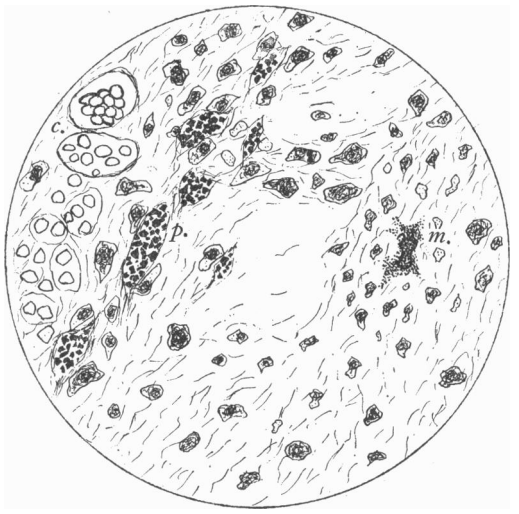

Fig. 6.

Fig. 5. Anterior lobe, human pituitary, near infundibulum. *m* = mast cell (rare in anterior lobe); *b.* = basophile cell (fine blue granules); *a.* = eosinophile cell (fine pink granules); *c.* = chromophobe cell; *s.* = sinusoid.

Fig. 6. Infundibular region of human pituitary. Contrast mast cell with pigment masses. *m.* = mast cell; *p.* = pigment masses (stained green); *c.* = capillaries on outer wall of infundibulum.

healthy fully active cells, and although further investigations of their intracellular structures will be required before a conclusive statement can be made, it is apparent that, whatever be their function, they are not degenerated anterior or intermediate lobe elements.

Although I have not made silver preparations as yet, there can be no doubt that these cells are not nerve cells. Nissl's granules have an entirely different appearance from the coarse rounded purple granules of these cells. It is also certain that these cells are to be clearly distinguished from cells of the type described by Lewis and Lee (8) as basophilic granular cells occurring in the pars nervosa of elderly subjects. The pictures given in their article make the distinction obvious even apart from their description.

That the cells are identical with mast cells is not proven yet, but the ordinary histological appearances leave little doubt about this. Their granules of course distinguish them from the few histiocytic elements that may occur in many glandular organs (see Lubarsch (9) and the chapter on "Macrophages or Histiocytes" in Cowdry (10)).

As regards the function of these cells little can be surmised until further investigation of their amoeboid and phagocytic powers and their reactions to vital dyes are tested. However, their apparent wide distribution in the mammalian pituitary and their abundance therein, and their relation to the hypophysio-portal vascular system recently described by Popa and Fielding (4) suggest that they exercise some function in connection with the mode of secretion and its carriage into the blood or cerebrospinal fluid.

SUMMARY

In this preliminary note the observation is recorded of the presence of numerous mast cells in the pars nervosa, and particularly in the infundibulum of the pituitary body of cattle, the cat and Man.

Their appearance of wandering, particularly along the infundibulum, is noted, and their frequent intimate association with the primary capillary net of the hypophysio-portal system is described.

I am indebted to Prof. H. J. Wilkinson for his kindly interest and advice, and to Prof. J. B. Cleland, who has spared no pains in providing me with human pituitaries.

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