pressure sudden release of the constricting pressure in every instance produced an immediate diminution of finger-tip volume below the original level and usually greater than the volume increase resulting from occlusion. The volume loss may be due entirely to primary, active constriction of the non-arterial vessels or in part to constriction of arterial vessels which could through diminution of blood flow within the capillaries and venules allow a passive constriction of these small vessels. We believe that the constriction is predominantly a non-arterial phenomenon.

The critical pressure at which the type of response changes is an index of tone of the vessels responsible for the volume change at that time. The mechanism of the response is not known but it is likely that it is initiated by increased intravascular tension. That local constricting pressure without venous distension is not an adequate stimulus is evidenced by lack of response to sudden momentary pressure in the cuff. Active responses of veins to other stimuli have been reported by others.[2-5]

These phenomena are being studied further in normal and diseased individuals.

Summary. Secondary spontaneous diminution of volume of the finger-tip following sudden partial obstruction of the venous flow from the part is reported. The reaction seems to be due to active constriction of veins, venules and capillaries which may be initiated by increased tension within these vessels.

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Sympathetic Ganglion Cell Changes in Adrenalectomized Animals.

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Recent literature is replete with reports of the functional disturbances in animals deprived of their adrenal glands but offers little

2 Hooker, D. R., *Physiol. Rev.*, 1921, **1**, 112.

3 Krogh, A., *The Anatomy and Physiology of Capillaries*, New Haven, 1929, 2nd Ed.

4 Lewis, T., *The Blood Vessels of the Human Skin and Their Responses*. London, 1927.

5 Capps, R. B., *J. Clin. Invest.*, 1936, **15**, 229.

information as to accompanying structural changes. In view of the well-established physiological relationship between this gland and the autonomic nervous system the authors undertook a preliminary study of sympathetic ganglion cells in adrenalectomized cats with a view to determining what structural changes, if any, accompanied the adrenal insufficiency.

The procedure was as follows: The right adrenal gland was removed by a retroperitoneal approach and 7 to 10 days later the left gland was removed in a similar manner. Both operations were done under intraperitoneal nembutal anesthesia. The cats utilized for the study lived from 3 to 12 days following completion of the adrenalectomy. Five of these cats died of adrenal insufficiency and the remainder were killed by opening the thorax and abdomen under ether anesthesia and eviscerating the animal. The superior cervical and stellate ganglia only were removed in the first 6 animals but in the remainder the coeliac and the thoraco-lumbar chain ganglia were also removed. The material was fixed in formalin-acetic acid, sectioned in paraffin, and alternate sections stained with cresyl violet and iron haematoxylin.

Later, a series of experiments was designed to substantiate the preliminary findings as well as to provide for controls. Twelve male cats were kept for a period of 5 weeks, during which time they were given a vermifuge and fed on a well-balanced diet. All were subjected to the same conditions and all were in excellent nutritive state at the end of the 5 weeks. Six of the cats were then adrenalectomized as in the preliminary series. When one of the operated animals was autopsied a normal one was also killed and corresponding ganglia from the 2 cats were carried through the fixative, dehydrative fluids, paraffin, etc., in the same containers. Finally, sections of ganglia from the normal and from the operated animal were mounted on the same slide and thus stained simultaneously. This series disposed of any question of misinterpretation of our findings in the preliminary series due to possible alterations of cell structure by the technical procedure to which the preparations were subjected. It also answers the question of the effect of etherization on the Nissl substance since the normal animal required much more ether at autopsy than did the operated one.

An additional precaution may be mentioned by way of ruling out the possibility of the changes described being attributed to axon injury. Ganglia from 2 cats in which an attempt was made to destroy all nerve fibers in the region of the adrenals were examined as well as ganglia from animals which had been subjected to unilateral adrenalectomy only. In both cases all ganglia appeared normal.

Further controls indicated and carried out were as follows: Ganglia were examined from cats in various stages of inanition and from one cat which had been starved. Material was secured from a number of animals at varying intervals post-mortem. One cat was killed and kept at room temperature for 12 hours, during which time a ganglion was removed at 2-hour intervals. Other animals killed by repeated doses of nembutal and by unintentional overdose of the same drug were examined. In none of these cases were changes present of the nature of those found in the ganglia of adrenalectomized animals.

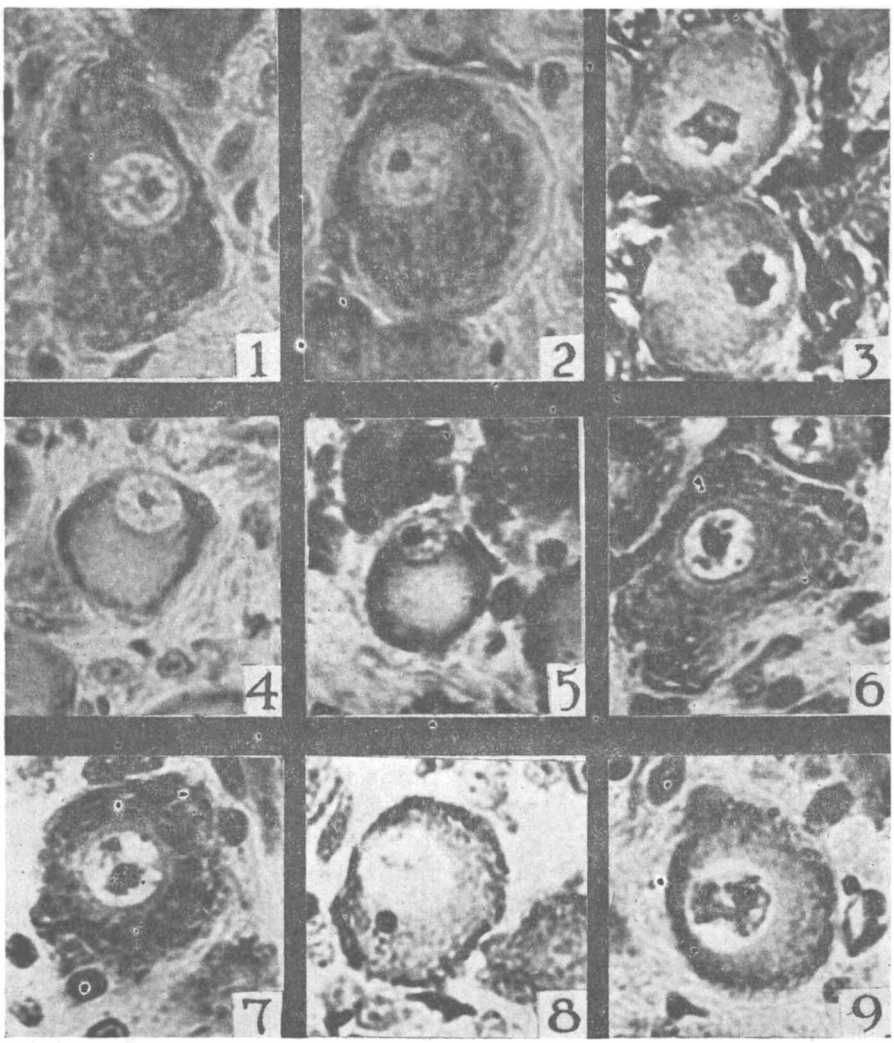
In observing the animals we have relied entirely on the classical physical signs of adrenal insufficiency. No blood or urine studies have been made because, for present purposes, we have been concerned solely with the autonomic ganglion cell picture and the degree of adrenal insufficiency is adequately indicated by physical signs alone. The animals show asthenia, anorexia, lowered body temperature, and circulatory disturbances corresponding to those outlined by other investigators.[1]

The study of ganglia for this report has been limited to the superior cervical and stellate. These ganglia were selected because of their easy accessibility and because of their distance from the operative field. However, the coeliac and the thoracic and abdominal chain ganglia show features in the experimental animals conforming to those described in the superior cervical and stellate. Each of the 18 cats from which ganglia were studied was suffering from adrenal insufficiency.

The ganglion cell changes in autonomic ganglia of the adrenalectomized animals may be mild or extensive, depending on the degree of insufficiency as indicated by the physical signs. But the degree of insufficiency is not a matter of time. It may become extreme in 3 days and some cats survive for 10 or 12 days. One cat which died on the fourth day showed more marked ganglion cell changes than another that died on the eleventh day after the final operation. The mild changes consist of swelling of cells and nuclei, chromatolysis, and disintegration of the Nissl substance which has a tendency to be more generally massed at the periphery of the cell than in the normal ganglion (Figs. 4 and 5). The more marked changes are pycnosis (Figs. 3 and 9) with occasionally extrusion of the nucleus from the cell (Fig. 5) and of the nucleolus from the nucleus (Fig. 8). The nuclear membrane may stain indistinctly or may appear fragmented. The cell bodies are often irregular and mark-

[1] Grollman, Arthur, *The Adrenals*, Williams and Wilkins Co., 1936, pp. 161-167.

edly shrunken and the Nissl substance either densely massed at the periphery, so that discrete granules can not be seen, or very finely granular and lightly stained. While the nuclei in autonomic ganglia have a tendency to be eccentric in position, that tendency is increased in the ganglia from the operated animals. The Nissl substance may



Figs. 1 and 2, normal sup. cerv., and figs. 6 and 7, normal stellate gang. cells. Fig. 3, pycnotic nuclei in sup. cerv. gang. cells 8 days after removal of second gland. Fig. 4, sup. cerv. gang. cell exhibiting early reaction. Fig. 5, sup. cerv. gang. cell, nucleus being extruded. Fig. 8, stell. gang. cell, nucleolus being extruded from nucleus. Fig. 9, pycnotic nucleus and peripheral Nissl substance. Fig. 3, iron hæmatoxylin; remainder, cresyl violet stain. × 500 before reduction.

normally be more abundant at the periphery of the ganglion cell, but it is often located centrally immediately surrounding the nucleus. Usually it is uniformly diffused throughout the cytoplasm. In the ganglia from cats suffering from adrenal insufficiency this substance is peripherally placed in the majority of cells (Figs. 4, 5, 8, and 9) but peripheral displacement alone does not indicate a degenerative change. The cell can only be considered as having an abnormal reaction in respect to Nissl substance when the latter loses its discrete granular character, a condition never encountered in normal ganglion cells in our studies. Vacuoles are frequently seen in the cytoplasm and when the nucleus is markedly shrunken the space it originally occupied remains as a vacuole between the shrunken nucleus and the cytoplasm (Figs. 3 and 9). The content of this space and other vacuoles does not stain with osmic acid nor with silver in our preparations. It is probably a fluid or semi-fluid substance.

The significance of the degenerative changes in autonomic ganglion cells in adrenal insufficiency is not entirely apparent from our experiments. Elliott[2] has offered experimental evidence to support his statement that animals deprived of their adrenal glands show a "nearly complete paralysis of vasomotor and cardio-accelerator nerves (all other nerves reacting in an approximately normal manner)." He found the vagus response to stimulus and pupillary reactions to be normal. Urechia and Mihaleschu[3] found similar changes in the nuclei of the *tuber cinereum*. They regard these nuclei as autonomic centers in the diencephalon. If the findings of Elliott are correct, the suggestion is offered that the ganglion cells degenerating in our animals are those concerned with vaso-constriction and cardiac acceleration, an explanation in accord with the fact that the great majority of the cells in these ganglia are undoubtedly vasomotor or cardio-accelerator in function. One might also suggest that the tuber nuclei showing degenerative changes in Urechia and Mihaleschu's experiments are probably vaso-constrictor and cardio-accelerator centers. However, a more extensive survey of the ganglia of the entire autonomic system and further study of autonomic centers will be necessary to warrant definite statements and further experiments directed to this end are in progress.

Ganglia other than the superior cervical and stellate do show degenerative changes in our series but the thoracic and abdominal chain ganglia appear to contain a greater proportion of normal cells than do the superior cervical and stellate. The coeliac is even more

[2] Elliott, T. R., *J. Physiol.*, 1914, **49**, 38.

[3] Urechia, G. I., and Mihaleschu, S., *Endocrinologie*, 1925, **3**, 296.

extensively involved than the latter ganglia, however. Attention has been called to degenerative changes in this ganglion in cases of Addison's disease.[4] Although Hollinshead[5] has shown that the nerve fibers to the adrenal medulla are preganglionic it seems likely that the cortex would receive some post-ganglionic fibers from the coeliac ganglion. Hence some of the changes in that ganglion may represent axonal reaction.

Summary. The cells of the autonomic ganglia of cats deprived of their adrenal glands for a sufficient time to bring about classical signs of adrenal insufficiency present definite degenerative changes. These changes vary in degree directly with the severity of the insufficiency as indicated by the physical signs. No definite statement can be made as to the significance of these findings in so far as our studies are concerned but the suggestion is offered that autonomic ganglion cell degeneration may explain some of the vasomotor disturbances in adrenal insufficiency. Neither is it possible to offer an explanation as to how the adrenal insufficiency affects the ganglion cells—whether as a part of a general metabolic disturbance or in some more direct, or even more complex, manner.

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Do Cysts of *Endamoeba histolytica* Formed in the Intestine Excyst Before Evacuation and Cause Internal Autoinfection?*

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The following study was designed to determine whether internal antoinfection from cysts of *Endamoeba histolytica* occurs. By internal autoinfection is meant the excystation of cysts formed in the intestine and their invasion of the tissues of the host without leaving the body. The term does not refer to "anus to mouth" transmission of cysts nor to reinvasion of the gut by the trophozoites.

Sellards and Theiler[1] claim to have infected 6 of 8 kittens by injecting material containing cysts only into the colon following

[4] McCrae, Thomas, *Osler's Principles and Practice of Medicine*, tenth edition, 1927, p. 882.

[5] Hollinshead, W. H., *J. Comp. Neurol.*, 1936, **64**, 464.

* Conducted in part as a project of the Amebiasis Unit of the National Institute of Health at Tulane University.

[1] Sellards, A. W., and Theiler, M., *Am. J. Trop. Med.*, 1924, **4**, 309.