SOME FORMS OF INTERNEURONAL CONTACTS IN VEGETATIVE GANGLIA

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The nerve cells of the vegetative ganglia are in morphological and physiological contact with the organs they innervate and with the nerve centers of the spinal cord and brain. These latter, called interneuronal, are represented by the pericellular net formed by the endings of the preganglionic fibers as they penetrate to the body of the nerve cell extending under its capsule and making contact as rings and buttons with the body and dendrites. There has been established the fact that a perifibrillar substance exists, surrounding the neurofibrillar frame of the synaptic ending of the preganglionic fiber [7,10,13].

In the studies made of the relations between the endings of the preganglionic fibers and the protoplasm of the bodies of the nerve cells within the vegetative ganglia, so far, but little attention has been devoted to the especially intimate contacts these have. It is assumed that at this very point [11] the impulse is transmitted across its special membrane using the biochemical physiologic meaning of that word [20]. One should not overlook mentioning the possible role played by the satellite cells of the nerve capsule in the transmission of the impulse from neuron to neuron by, for example, mediators of the acetylcholine type [16,19]. These cell satellites, being elements of the peripheral glia, form along with the neurons and nutrient vessels a single morphophysiological complex.

Further study of the vegetative ganglia has shown that they have not only efferent but also afferent neurons and so must be considered as containing a mixture of elements.

V. M. Bechterev [2] wrote that, "essentially, the ganglionic or sympathetic nervous system is really an off-shoot of the central nervous system and just as this latter consists of individual nerve elements or units conducting impulses centrally and peripherally so also the sympathetic system consists of a ganglionic chain composed of varying nerve elements touching and intercommunicating with each other, effector as well as sensory units being present these latter to transmit to the brain impulses from our inner organs." At almost the same time, A. S. Dogiel [17] divided the nerve cells of the vegetative system into three types and pointed to the cells of the second type as being sensory, the intrinsic receptors of the autonomic system. Soon afterwards A. S. Dogiel [18] and S. E. Mikhailov [14] discovered the presence in autonomic ganglia of sensory endings disposed in the stroma between the nerve cells. These receptors have been lately extensively examined by N. G. Kolosov [10] and his students and this group has described various intra- and extracapsular endings in the solar plexus, the bordering sympathetic chain, in ganglia around the larynx, bronchi, nodes of the digestive tract, mesentery and so on.

Inadequate knowledge of the stroma of the vegetative ganglia, particularly of its blood vessels, has so far made rather difficult the precise physiological evaluation of the receptors just described. It must be assumed that some of these receptors arise from the walls of the blood vessels [3,4,5], others are related to the stroma, neurons and the glia surrounding them [9,10].

In addition, lately N. G. Kolosov [9,10], T. A. Batireva [1], G. A. Koblov [8], Yu. I. Slepkov [15] and others have demonstrated within the vegetative ganglia "afferent, pericapsular elements originating largely from coarse, myelinated fibers which, approaching the neurons, lose their sheath and fragment into several fine, nonmedullated fibers which terminate on the surface of the capsule of the nerve cell as rings or buttons" [10]. As can be noted, the principal morphologic differentiation from the already known pericellular apparatuses lies in the disposition of these fibers exclusively outside the capsule of the nerve cell. It is understood that the afferent character of this type of pericapsular apparatus can be finally proven only by using the method of sectioning the sensory nerve fibers and then observing the consequent degeneration. In the laboratory of N. G. Kolosov this has been done.

Fig. 1. Pericapsular ending formed by the terminal branchings of a coarse, myelinated fiber. Bielschowsky-Gross. Eye-piece x 10, obj. x 40.

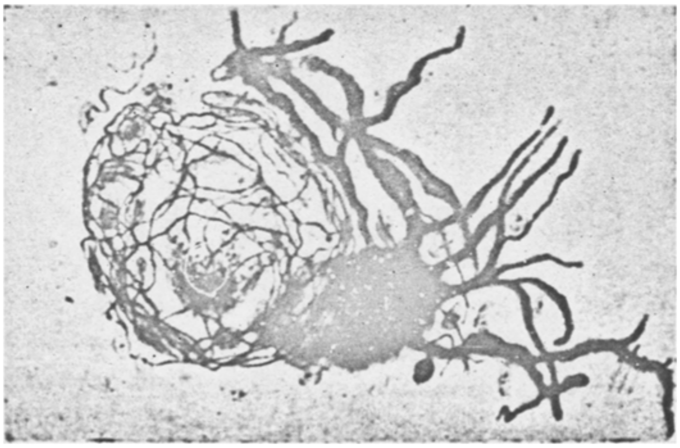

Fig. 2. Pericapsular network formed by fine nerve fibers. Impregnated after Bielschowsky-Gross. Eye-piece x 10, obj. x 40.

The next step is to accumulate data which will allow us to establish that the pericapsular apparatus is as much a structural part of the neuron as the pericellular apparatus.

In studying the nerve net of the human kidney, along with the pericellular apparatus, there were uncovered many structures having a close relation to the capsule of the nerve cells. The simplest of them are composed of a single or several nerve fibers forming a few branchings around the capsule (Fig. 1). More complex is the structure represented by the heavy mesh of fine nerve fibers enveloping the capsule of the nerve cell in the manner of a cocoon (Fig. 2). Quite often it can be observed how one or several fibers, before entering into this mesh, wind spirally around a dendrite and only then continue over the outer surface of the capsule (Fig. 3). At the same time, it should be noted that between the capsule and the mesh covering it and, the body of the nerve cell, there is seen a distinct space into which the above-mentioned fibers do not penetrate and, hence, do not form pericellular apparatuses (Fig. 4).

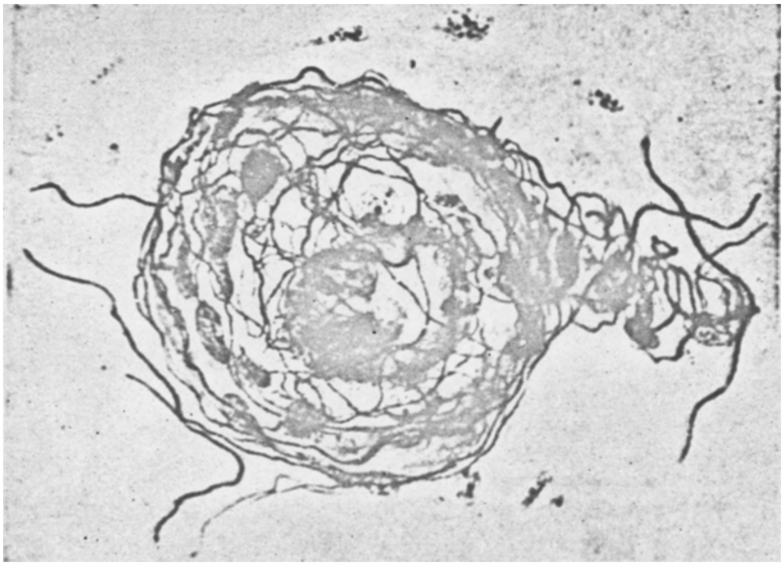

Fig. 3. Pericapsular mesh formed by fine nerve fibers. One fiber winds in a spiral around a dendrite. Imprégnation after Bielschowsky-Gross. Eye-piece x 10, obj. x 40.

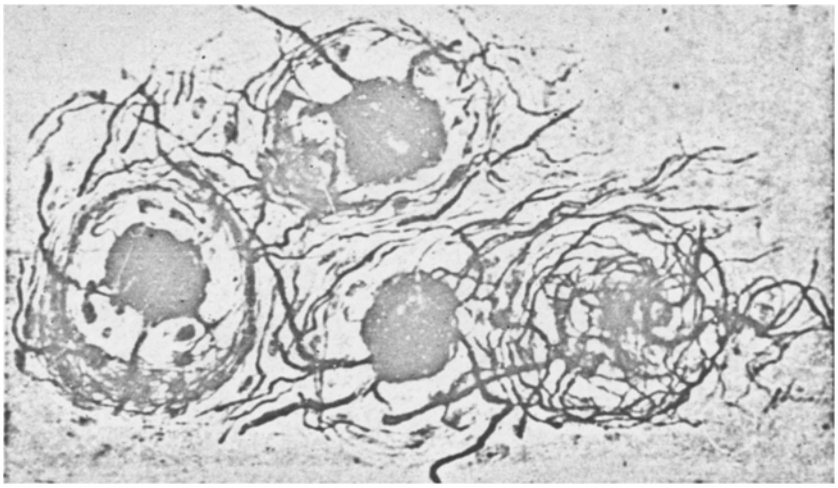

Fig. 4. Group of nerve cells having pericapsular networks. Fibers can be seen which wind spirally around dendrites. Impregnation after Bielschowsky-Gross. Eye-piece x 10, obj. x 40.

All this permits us to consider these structures as being different from the known types of interneuronal contacts forming pericellular apparatuses and so we may point to the similarity in our microphotographs to those presented by N. G. Kolosov [9,10] and others as "special afferent devices."

Quite obviously, so far it is difficult to assign a definite meaning to these pericapsular apparatuses in the autonomic ganglia. We might recall the words of B. I. Lavrentiev [12] who states, "each time that an impulse from a preganglionic fiber transfers to the neuron of the peripheral ganglion, the event is signalled to the central nervous system. In other words, the synaptic transmission in the ganglia of the vegetative system is under constant control by the central nervous system." Other theories, of course, might be advanced but it is far better to direct our attention to morphological and physiological experiments so devised as to be definitive in elucidating the problem of the peculiarities of the inter neuronal contacts in vegetative ganglia.

SUMMARY

Neural fibers forming pericapsular plexuses around the human renal kidney are depicted on the microphotographs shown. A clear space between the cell body and this plexus has been demonstrated. It is assumed that there is no pericellular apparatus and that the pericapsular apparatus demonstrated is, most probably, of an afferent character.

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