A HISTOLOGICAL STUDY OF THE AFFERENT INNERVATION OF THE OVARY OF THE DOG

by

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[Received for Publication Aug. 2, 1955]

I INTRODUCTION

K. KAWAKAMI and A. KUBO have reported on sensory reactions caused by stimulation of the ovary of the dog, and Sh. ASAI has proved the existence of ovarian sensitivity in rabbits from the physiological point of view. According to Ch. KIMURA and Y. YOSHIIKE of our clinic, pain sensitivity can be aroused in human ovaries by stimulating them with electric faradization or injecting acetylcholine into them, and the existence of ovarian sensitivity can be also proved in cats by similar methods.

In the human ovary, J. SAKAGUCHI found nerve endings which end freely and can be distinguished clearly from end-apparati of the autonomic nervous system in many respects and maintained that these nerve endings belong to sensory nerve end-apparati (SETO). But he did not pursue the routes of these nerves.

The fact that the sympathetic nerves, the vagus and the sacral parasympathetic nerves all contain visceral afferent fibers has been proved by many investigators on the basis of their histological or physiological studies. As regards the innervation of the ovary, G. A. G. MITCHELL, A. KUNTZ, J. C. WHITE, R. H. SMITHWICK, T. KURE and Sh. OKINAKA have recognized the fact that the ovary is innervated through the ovarian plexus which consists of thoraco-lumbar sympathetic fibers. But I could find no literature which proved anatomically the innervation of the ovary through the vagus or the sacral parasympathetic nerves. So, it can be guessed that three main pathways, the vagus, the thoraco-lumbar sympathetic nerves and the sacral parasympathetic nerves, play important roles in conducting the afferent impulses from the ovary; of these, the sympathetic nerve is the most important. Nevertheless, I have found no literature of any histological study on this subject, so I attempted to solve the problem histologically.

II MATERIALS AND METHODS

At the beginning of my study, preparations of extirpated human ovary were stained with BIELSCHOWSKY-SETO's and BIELSCHOWSKY-SUZUKI's silver methods. In addition to autonomic nerve fibers and end-apparati (Fig. 1), the presence of SETO's sensory nerve fibers and endings, which had been recognized by J. SAKAGUCHI, was confirmed (Fig. 2, 3 and 4). The existence of myelinated fibers was also confirmed by staining with EHRLICH's acid hematoxyline method (Fig. 5).

Next, preparations of ovaries of normal adult dogs were stained with the same three methods, and the nerve apparati were examined, comparing them with those of human ovaries.

Adult female dogs were mainly used. The spinal nerves and the vagus were sectioned at various points, and the secondary degenerations of nerve fibers in the ovaries were investigated mainly by EHRLICH's method and also by BIELSCHOWSKY-SUZUKI's silver method.

It could be anticipated from the results of many previous experiments performed by many investigators, that the greater part of the afferent fibers from the ovary pass through the sympathetic trunk. J. N. LANGLEY had described that the visceral afferent fibers which pass through the sympathetic trunk have their cell-stations in the dorsal root ganglia. Therefore, the dorsal roots (Th. 10…L. 2) on one side (right side) of three female adult dogs were sectioned at points distal to their ganglia. Then both ovaries were extirpated 7 days later in the first case, 14 days later in the second case and 21 days later in the third case, and were examined to determine whether any changes had occured in the nerves supplying them. In each case I could find no difference between the left ovaries and normal ovaries when stained with EHRLICH's method and BIELSCHOWSKY-SETO's method. On the other hand in the right ovaries (sectioned side), I found marked diminution of myelinated fibers when stained with EHRLICH's method and of SETO's sensory nerves when stained with BIELSCHOWSKY-SETO's method. Moreover, I found a few degenerated fibers in the extirpated ovary of the right side 7 days after the operation using EHRLICH's method (Fig. 6). Considering these results, I thought that removing the ovaries 7 days or more after the rhizotomies was too late. Therefore, the ovaries of another dog were extirpated 5 days after a similar rhizotomy (Th. 10…L. 2 of the right side), and were investigated. Then I found many degenerated fibers in the right ovary of this dog with EHRLICH's method as well as BIELSCHOWSKY-SUZUKI's method. So, I determined to extirpate ovaries 5 days after the section of the spinal roots at points distal to their ganglia.

Operations were performed as follows:

(1) Section of the dorsal roots on the right side (Th. 10…L. 2).
(2) Section of the dorsal roots on both sides (Th. 9…Th. 12).
(3) Section of the dorsal roots on both sides (Th. 13…L. 4).
(4) Section of the dorsal roots on both sides (L. 5…L. 7).
(5) Section of the dorsal roots on the right side (L. 6…S. 3).
(6) Section of the dorsal roots on both sides (S. 1…S. 3).
(two dogs, one adult and the other three months old were operated.)
(7) Section of the dorsal roots on the right side (S. 1…S. 3).
(8) Section of the ventral and dorsal roots on the right side (S. 1…S. 3).
(9) Section of the ventral roots on the right side (S. 1…S. 3).
(10) Section of the ventral and dorsal roots on the right side (S. 1…Co. 5).
(11) Section of the ventral and dorsal roots on the right side (Co. 1…Co. 5).

Then vagotomies were performed as follows, to decide whether afferent nerves from the ovary are present in the vagus nerve or not.

(12) Cervical vagotomy on the right side at a point distal to the ganglion nodosum. (Ovaries were extirpated 6 days after the operation.)

(13) Cervical vagotomy on the left side at a point distal to the ganglion nodosum. (Ovaries were extirpated 6 days after the operation.)

(14) Bilateral vagotomy in the thorax. (Ovaries were extirpated 7 days after the operation.)

III MICROSCOPIC OBSERVATIONS

A) Intrinsic nerves of the ovaries of normal adult dogs.

First, preparations were examined using BIELSCHOWSKY-SETO's and BIELSCHOWSKY-SUZUKI's silver methods. In the nerve bundle at the hilum, sensory nerves (SETO), which are thick and have characteristic variations in their thickness (varicosities), are distinguished clearly from the autonomic nerve fibers which are thin and smooth (Fig. 7). After entering the stroma of the ovary and anastomosing with one another, the greater part of the autonomic fibers spreads over the medulla and only some parts spread over the cortex or the adventitia of the vessels, and there, they branch into finer and finer fibers without ending freely, and at last form closed "nervöse Terminalreticulum (STÖHR)" (Fig. 8 and 9). These "Terminalreticulum" are similar to those of the human ovary recognized by M. GOECKE and J. SAKAGUCHI.

Many investigators have had many different opinions as to nerve distribution to follicles. In dog ovaries A. KUNTZ have observed no nerve fibers which penetrate follicles or terminate in follicles. In human ovaries J. SAKAGUCHI have recognized that a few nerve fibers penetrate into the follicle cell layer but no fibers enter the ova. According to the latest report by H. KNOCHE, winding or spiral non-myelinated nerve fibers can be found in the ooplasm around the ovum nuclei of prime-follicles, in ape ovaries. In a few preparations of dog ovaries, I could pursue some fine nerve fibers close to the ova of prime-follicles, but I could not assert that these fibers terminate in relation to the ova.

On the other hand, sensory nerves, too, are morphologically similar to those of the human ovary recognized by J. SAKAGUCHI; sensory nerves have characteristic variations in their thickness (varicosities) and pathways, which distinguish sensory nerves from autonomic fibers, and they terminate in many branched terminal endings in the medulla and cortex in contact with the medulla (Fig. 10). In addition to these sensory nerves, I could find no sensory endings with a specific complicated from.

No ganglion was found in any part of the ovary of dogs.

Further investigations were performed with EHRLICH's method. After passing through the hilum into the parenchyma along with many non-myelinated fibers, myelinated fibers have similar pathways and branchings to those of sensory nerves (SETO) described above (Fig. 11). Few myelinated fibers were found in the cortex, and fine branchings as recognized by the silver method could not be found by this method. So, it is reasonable to think that afferent fibers become non-myelinated when approaching their ends.

B) Secondary degeneration of myelinated fibers and SETO's nerves in the ovaries after sectioning.

(1) Section of the dorsal roots on the right side (Th. 10···L. 2).

The ovary of the right side ··· Secondary degeneration of a majority of myelinated fibers in the nerve bundles at the hilum and in the parenchyma was found with EHRLICH's method (Fig. 12 and Fig. 13). With BIELSCHOWSKY-SUZUKI's method, secondary degeneration or disappearance of a majority of sensory nerves was recognized in the nerve bundles at the hilum (Fig. 16a, 16b and 16c). In the parenchyma, no secondary degeneration of the axis-cylinders was found with the silver method. So, as for the degeneration of the axis-cylinders, it may be presumed that the nearer to the endings they are, the more rapidly they degenerate and are absorbed.

The ovary of the left side ··· No degenerated nerve fibers were found.

(2) Section of the dorsal roots on both sides (Th. 9···Th. 12).

Secondary degeneration of a minority of the myelinated fibers in the nerve bundles at the hilum and in the parenchyma of the ovaries of both sides was found with EHRLICH's method (Fig. 14).

(3) Section of the dorsal roots on both sides (Th. 13···L. 4).

With EHRLICH's method, degeneration of a majority of the myelinated fibers in the nerve bundles at the hilum and in the parenchyma was found (Fig. 17a, 17b and 17c).

(4) Section of the dorsal roots on both sides (L. 5···L. 7).

No degenerated nerve fibers were found in the ovaries of either side.

(5) Section of the dorsal roots on the right side (L. 6···S. 3).

No degenerated nerve fibers were found in the ovaries of either side.

(6) Section of the dorsal roots on both sides (S. 1···S. 3).

No degenerated nerve fibers were found in the ovaries of either side.

(7) Section of the dorsal roots on the right side (S. 1···S. 3).

No degenerated nerve fibers were found in the ovaries of either side.

(8) Section of the ventral and dorsal roots on the right side (S. 1···S. 3).

No degenerated nerve fibers were found in the ovaries of either side.

(9) Section of the ventral roots on the right side (S. 1···S. 3).

No degenerated nerve fibers were found in the ovaries of either side.

(10) Section of the ventral and dorsal roots on the right side (S. 1···Co. 5).

The ovary of the right side ··· Secondary degeneration of a minority of the myelinated fibers in the nerve bundles at the hilum and in the parenchyma was found with EHRLICH's method (Fig. 15 and 18). Secondary degenerating-granules of nerve fibers in the vessel plexus at the hilum and deformation of the axis-cylinders in the parenchyma, which are thought to be degeneration of the axis-cylinders, were found with BIELSCHOWSKY-SETO's and BIELSCHOWSKY-SUZUKI's methods (Fig. 19 and 20).

The ovary of the left side ··· No degenerated nerve fibers were found.

(11) Section of the ventral and dorsal roots on the right side (Co. 1···Co. 5).

No degenerated nerve fibers were found in the ovaries of either side.

(12), (13) and (14) Vagotomy.

No secondary degeneration of nerve fibers was found in any case in which vagotomy was performed at various points.

IV DISCUSSION

I have found in the dog ovary as well as in the human ovary, besides nerve fibers belonging to the autonomic nervous system which have been systematized by P. Stöhr jr., Seto's sensory nerves which have free endings and can be clearly distinguished from the autonomic fibers morphologically. In general, it has been thought that sensory endings have special complicated formations. But in the ovary of the dog no nerve ending having such a formation was found. G. Weddell stated that sensory nerve endings of the skin are, in general, free-ending arborizations. And Seto's sensory endings in the ovary of the dog have the same appearance. H. Seto has asserted that Seto's nerve, which differs from autonomic nerves morphologically, may also differ in function, and is probably sensory in function. H. Seto's opinion can also be applied to the nerves in the dog ovary.

J. N. Langley's opinion, that visceral afferent fibers passing through the sympathetic trunk have cell-stations in the dorsal root ganglia and have no interposing cell in their periphery, has generally been recognized. In accordance with this fact, I sectioned the spinal nerves at points distal to their ganglia, and discovered secondary degenerations of myelinated fibers in the ovaries, as expected. But, it is doubtful whether all the myelinated fibers in the ovary are afferent. At least some of the autonomic fibers are myelinated in the nerve trunk. Dahl and J. Sakaguchi etc. observed no ganglion cell in the human ovary, and A. Kuntz etc. observed none in the ovary of the dog. In the preparations of human and dog ovaries stained with the silver method, I, too, could find no ganglion cell. Therefore, it is probable that the myelinated fibers in the ovary do not contain preganglionic fibers of autonomic nerves. But there has been no evidence proving that the postganglionic fibers are non-myelinated, except in the vagus. According to the study of Sh. Okinaka and T. Kure, there are spinal parasympathetic nerves which are efferent, myelinated and small-sized and which pass through the dorsal roots and have their cell-stations in the dorsal root ganglia, and some of these nerves pass through the white rami and reach viscerae. If these spinal parasympathetic nerves were myelinated till their periphery and had no interposing cells, then some of the myelinated fibers in the ovary showing secondary degeneration might be considered spinal parasympathetic fibers. But after sectioning the nerve trunk, not only the small-sized myelinated fibers, but also the middle-sized myelinated fibers (over 3μ) were found degenerated in the ovaries. Moreover, in some cases in which several dorsal roots in a certain area were sectioned, the majority of the myelinated fibers containing middle-sized fibers in the ovaries of the sectioned side were found degenerated, and marked diminution of Seto's sensory nerves in the ovaries of the sectioned side was recognized a few days after operation. Considering these results, it is reasonable to consider that at least the majority of the myelinated fibers in the ovary are afferent.

F. H. EDGEWORTH, basing his opinion upon his histological study of the dog, has asserted that the ovary has a sensory supply through large-sized myelinated fibers in the sympathetic trunk. A. KUNTZ has stated that the afferent fibers innervating the human ovary are mainly derived from the 10th thoracic nerve. The sensory innervations of viscerae of frogs were studied by K. KAWAKAMI and A. KUBO. The former proved that the sensation of the ovary was conducted through afferent fibers in the splanchnic nerve, and the latter through afferent fibers in both the vagus and the sympathetic nerves. The triple sensory innervation of the ovary of the rabbit through the sympathetic nerve, the vagus and the pelvic nerve was proved by Sh. ASAI. Physiological studies by Ch. KIMURA and Y. YOSHIIKE have shown that sensory innervation of the human ovary is thoraco-lumbar, and that sensory innervation of the ovary of the cat is both thoraco-lumbar and sacral, the former being dominant. The afferent innervation of the dog ovary, according to my experimental results, will be discussed as follows.

(1) The thoraco-lumbar afferent innervation.

After sectioning the dorsal roots of Th. 10 … L. 2 on the right side, secondary degeneration of a majority of the myelinated fibers in the right ovary was found, but there was no change of any nerve fiber in the left ovary. After sectioning the dorsal roots of Th. 13 … L. 4 on both sides, secondary degeneration of a majority of the myelinated fibers in both ovaries was found. After sectioning the dorsal roots of Th. 9 … Th. 12 on both sides, secondary degeneration of a minority of the myelinated fibers in both ovaries was found. After sectioning the dorsal roots of L. 5 … L. 7 on both sides, no secondary degeneration was found in either ovary. These results show that most of the myelinated fibers in the ovary pass through the thoraco-lumbar dorsal spinal roots of the same side (mainly Th. 13 … L. 2), and therefore the afferent innervation of the ovary is chiefly thoraco-lumbar. This fact coincides with many former physiological investigations, especially with the experimental results of Y. YOSHIIKE, and with the opinion of J. F. FULTON etc. that the area of the thoraco-lumbar outflow of autonomic nerves is Th. 1 or Th. 2 … L. 4 in the dog and the white rami are restricted to the thoraco-lumbar region.

(2) The sacral afferent innervation.

I have found secondary degeneration of a minority of the myelinated fibers in the right ovary of the dog, when the ventral and dorsal spinal roots (S. 1…Co. 5) were sectioned on the right side. Nevertheless, in many other dogs in which the ventral or dorsal spinal roots had been sectioned, no change was found in the nerve fibers in their ovaries.

J. F. FULTON has stated that the pelvic nerves of the dog emerge from the sacral segments (S. 1…S. 3), and Y. NITTA has proved the existence of afferent fibers which have their cell-bodies in the sacral dorsal root ganglia, in the pelvic nerve. In my preparations in which secondary degeneration was found, the appearance of the degeneration was so clear that I could have no doubt about it. Therefore, it is certain that in some dogs, at least, a minority of the myelinated fibers in the ovary are innervated from the sacral region and these fibers pass through the pelvic nerves of the same side. But I can not be sure why in many other dogs no degeneration could be found; probably the sacral innervation is too indefinite for secondary degeneration to extend to the ovary, or perhaps in some cases there is no sacral innervation in the ovary. Anatomical study by G. A. G. MITCHELL has shown that the sacral parasympathetic innervation of the ovary is very small, if it exists. And according to the physiological study of Y. YOSHIIKE, the sacral sensory innervation of the ovary is slight and in some occasions can not be proved. These anatomical and physiological studies coincide to a great extent with my experimental results. So it can be said that the ovary is innervated by the sacral region, though very slightly.

(3) The vagal afferent innervation.

I have found no literature which presented histological evidence of the vagal innervation of the ovary. Moreover, I have found only a few papers which proved physiologically the vagal sensory innervation of the ovary, including the experiment by A. KUBO which recognized the vagal sensory innervation in the frog's ovary and the study by Sh. ASAI which recognized very slight vagal sensory innervation in the rabbit's ovary. It has been thought that the cell-bodies of the afferent fibers of the vagus lie in the ganglion nodosum (S. W. RANSON etc.), so I sectioned the vagus in the neck or in the thorax. But in all cases no change was found in any nerve fibers in the ovaries. Therefore, vagal afferent innervation to the ovary is doubtful.

By pursuing the afferent myelinated nerve fibers in the ovary, I have proved a dual afferent innervation in the ovary of the dog; one is the dominant thoraco-lumbar innervation and the other is the secondary sacral innervation.

But I can not assert that these two innervations are the only innervation of the ovary. S. W. RANSON and P. R. BILLINGSLEY have presented the evidence of non-myelinated visceral afferent fibers in the sympathetic trunk. And Sh. OKINAKA and S. HIRAMATSU have asserted that the ventral spinal roots contain visceral afferent fibers. But I have not been able to trace them.

V CONCLUSION

The afferent nerves in the dog ovary have been studied, by using EHRLICH's acid hematoxylin method, BIELSCHOWSKY-SETO's and BIELSCHOWSKY-SUZUKI's silver methods. Also by pursuing the secondary degeneration of nerves in the ovary after section of the nerve trunks, I have been able to study the route of afferent nerve distribution of the ovary, and have come to the following conclusions:

(1) Myelinated nerve fibers and SETO's sensory nerves are also found in the dog ovary.

(2) Most of the afferent myelinated fibers of the dog ovary enter the thoraco-lumbar spinal cord, passing through the dorsal spinal roots (mainly Th. 13…L. 2) of the same side.

(3) A minority of the afferent myelinated fibers of the ovary of some dogs enter the sacral spinal cord passing through the sacral roots of the same side. This

innervation is secondary compared with the dominant thoraco-lumbar innervation.
(4) Afferent vagal innervation of the ovary was not proved.

I am greatly indebted to Assistant Prof. Dr. CHUJI KIMURA of our clinic for his constant help during the course of this study.

EXPLANATION OF THE PLATES

Fig. 1 "Nervöse Terminalreticulum" in the medulla of human ovary. × 1000 (BIELSCHOWSKY-SETO's stain)

Fig. 2 SETO's sensory nerve, which can be distinguished clearly from the autonomic nerves, in the nerve bundle at the hilum of human ovary. × 500 (BIELSCHOWSKY-SETO's stain)

Fig. 3 SETO's sensory nerve in the medulla of human ovary. × 300 (BIELSCHOWSKY-SETO's stain)

Fig. 4 SETO's sensory nerve near its end, in the cortex of human ovary. × 300 (BIELSCHOWSKY-SETO's stain)

Fig. 5 Myelinated fibers in the medulla of human ovary. × 200 (EHRLICH's stain)

Fig. 6 Degeneration of a myelinated fiber in the medulla of a dog's right ovary extirpated 7 days after rhizotomy of Th. 10…L. 2 on the right side. ×400 (EHRLICH's stain)

Fig. 7 SETO's sensory nerves, which can be distinguished clearly from the autonomic nerves, in the nerve bundle at the hilum of normal adult dog's ovary. × 800 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 8 Autonomic nerve fibers in the cortex in contact with the medulla of a normal adult dog's ovary. × 500 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 9 "Nervöse Terminalreticulum" in the medulla of a normal adult dog's ovary. × 1500 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 10 SETO's sensory nerve near its end in the cortex in contact with the medulla of a normal adult dog's ovary. × 500 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 11 Nerve bundle containing many myelinated fibers at the hilum of a normal adult dog's ovary. × 300 (EHRLICH's stain)

Fig. 12 Nerve bundle showing degeneration of most of the myelinated fibers, at the hilum of a dog's right ovary extirpated 5 days after rhizotomy of Th. 10…L. 2 on the right side. × 400 (EHRLICH's stain)

Fig. 13 Degeneration of myelinated fibers in the medulla of a dog's right ovary extirpated 5 days after rhizotomy of Th. 10 … L. 2 on the right side. × 400 (EHRLICH's stain)

Fig. 14 Degeneration of a few myelinated fibers in the nerve bundle at the hilum of a dog's left ovary extirpated 5 days after rhizotomy of Th. 9…Th. 12 on both sides. × 300 (EHRLICH's stain)

Fig. 15 Degeneration of a myelinated fiber in the nerve bundle at the hilum of a dog's right ovary extirpated 5 days after section of the ventral and dorsal roots of S. 1…Co. 5 on the right side. × 300 (EHRLICH's stain)

Fig. 16a, 16b and 16c Degeneration of SETO's sensory nerves in the nerve bundle at the hilum of a dog's right ovary extirpated 5 days after rhizotomy of Th. 10 … L. 2 on the right side. Photographs were taken in three layers. × 300 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 17a, 17b and 17c Degeneration of all the myelinated fibers in the nerve bundle at the hilum of a dog's right ovary extirpated 5 days after rhizotomy of Th. 13…L. 4 on both sides. Photographs were taken in three layers. × 300 (EHRLICH's stain)

Fig. 18 Degeneration of a myelinated fiber in the medulla of a dog's right ovary extirpated 5 days after section of the ventral and dorsal roots of S. 1…Co. 5 on the right side. × 400 (EHRLICH's stain)

Fig. 19 Degeneration of SETO's sensory nerve in the vessel-plexus at the hilum of a dog's right ovary extirpated 5 days after section of the ventral and dorsal roots of S. 1…Co. 5 on the right side. × 500 (BIELSCHOWSKY-SUZUKI's stain)

Fig. 20 Deformation of SETO's sensory nerve due to degeneration, in the medulla of a dog's right ovary extirpated 5 days after section of the ventral and dorsal roots of S. 1…Co. 5 on the right side. × 650 (BIELSCHOWSKY-SETO's stain)

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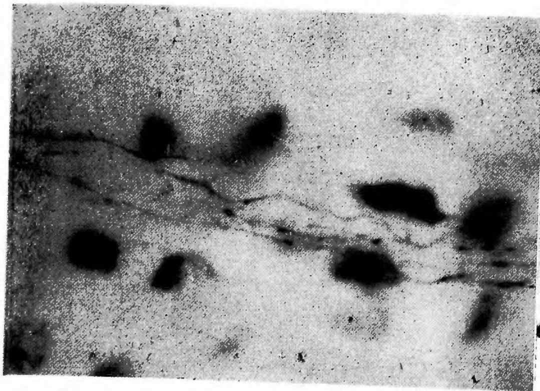


Fig. 1

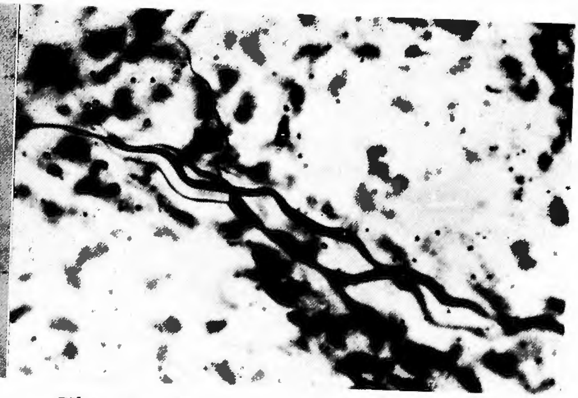
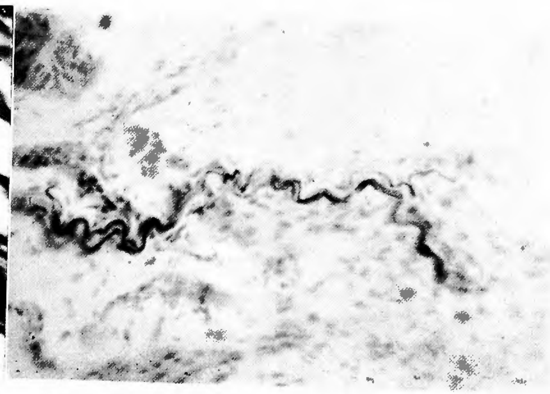


Fig. 4


Fig. 2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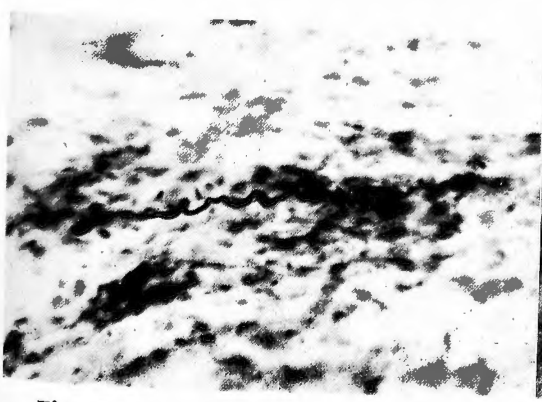


Fig. 3

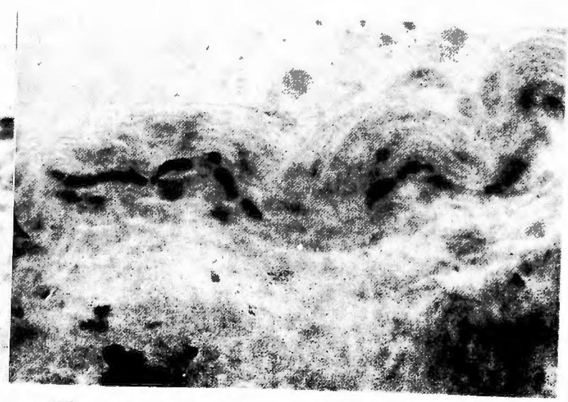


Fig. 6

H. SATO. 1

Figures

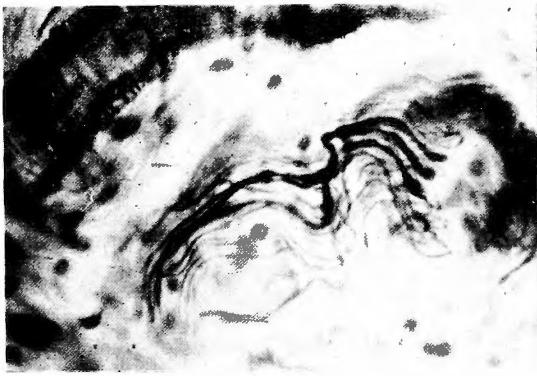
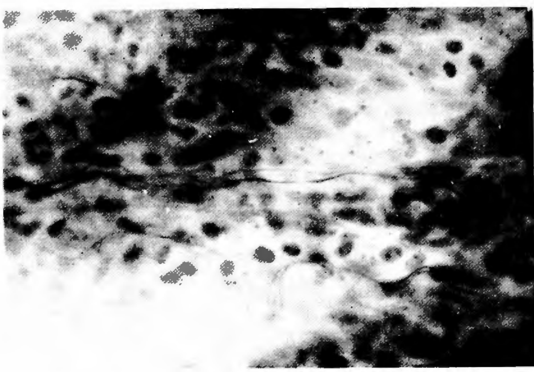


Fig. 7

Fig. 10



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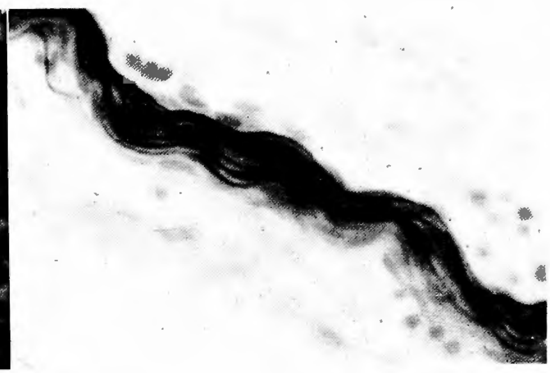


Fig. 11

Fig. 9

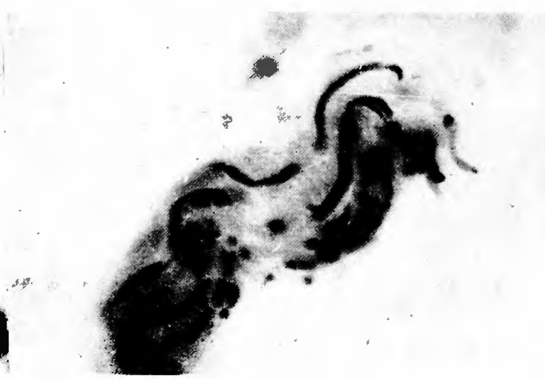


Fig. 12

H. SATO. 2

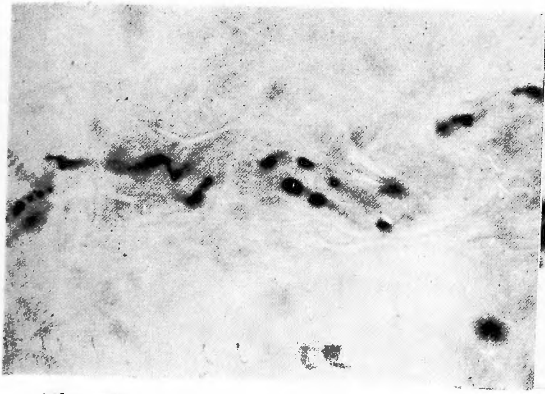


Fig. 13

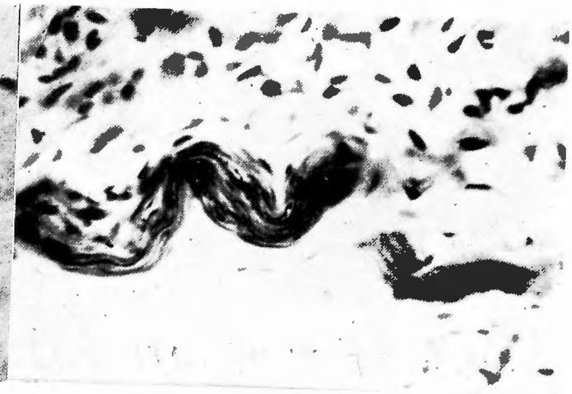


Fig. 16a

Fig. 14

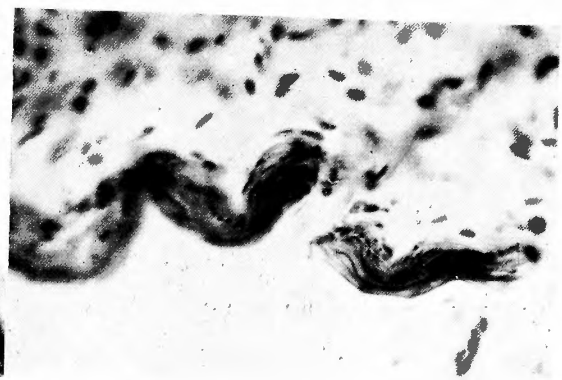


Fig. 16b

Fig. 15

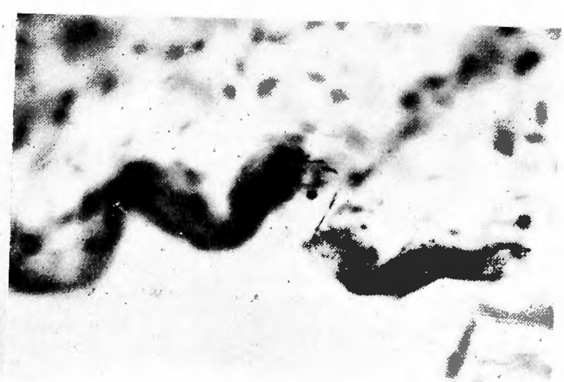
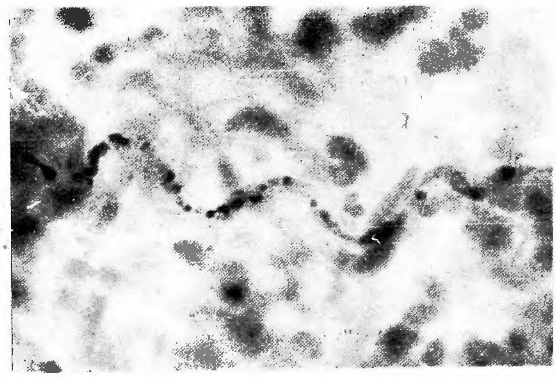


Fig. 16c

Figures

Fig. 17a



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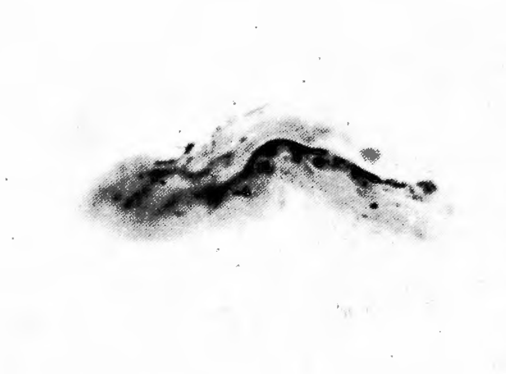

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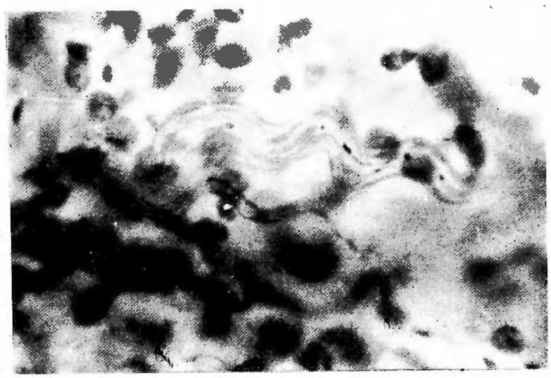

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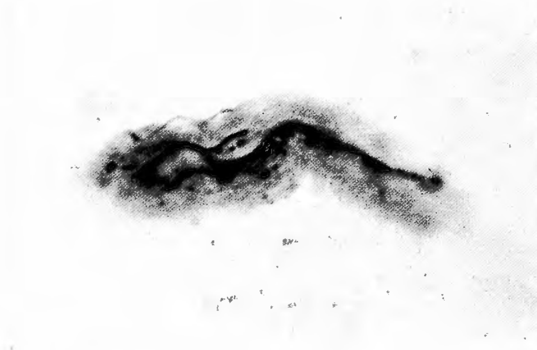

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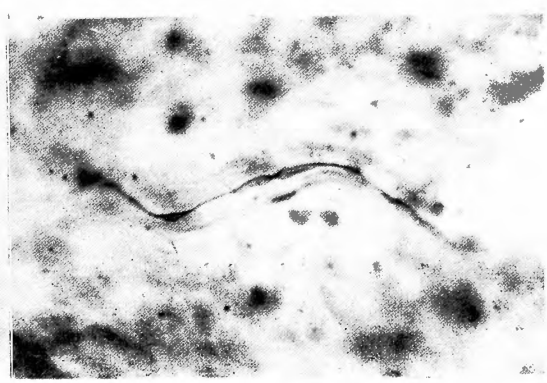

Fig. 20

Suzuki, K. : Note of Technique to make Tisssue-Preparations (Soshiki Hyōhon Seisaku Gijyutsu Nōto, in Japanese). (IV). Nōshinkei Ryōiki, **5**, 184, 1952. 31) Tanaka, N. : A Histological Study of the Dual Afferent Innervation of the Esophagus of the Dog. Arch. f. jap. Chir., **22**, 439, 1953. 32) Weddell, G. and Sinclair, D. C. : The Anatomy of Pain Sensibility. Acta Neuro-Veg., **7**, 1-4, 135, 1953. 33) White, J. C. and Smithwick, R. H. : The Autonomic Nervous System. 1946. 34) Yagita, M. : A Histological Study of Sensory Nerves in the Lung and the Visceral Pleura. Arch. f. jap. Chir., **23**, 569, 1954. 35) Yoshiike, Y. : Physiologic Studies on the Visceral Sensation of the Urogenital Organs. Arch. f. jap. Chir., **23**, 433, 1954.

和文抄録

犬卵巣の求心性神経支配に関する組織学的研究

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BIELSCHOWSKY 氏神経軸索鍍銀染色法の瀬戸氏変法及び鈴木氏変法並びに EHRLICH 氏神経髄鞘染色法を用いて犬卵巣の求心性神経について検討し，更に犬の神経幹切断による卵巣内の神経の二次的変性を追求することにより卵巣の求心性神経支配経路を検討して次の如き結論を得た.

(1) 犬卵巣に於いても有髄神経及び知覚神経（瀬戸）が存在する.

(2) 犬卵巣の求心性有髄神経の大部分は同側の脊髄神経後根を通り Th.13－L.2 を中心とする胸腰髄に入る.

(3) 犬卵巣の求心性有髄神経のうちの一小部分に同側の仙骨神経を通り仙髄に入るものが存在するがこれは胸腰性支配に比して極めて劣勢である.

(4) 犬卵巣の迷走神経性求心性支配は証明し得ない.