NEUROHISTOLOGICAL STUDY OF BENIGN TUMORS

by

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INTRODUCTION

Have the tumors the nerve tissue?

Many authors reported on this problem with great interest. These reports can be classified into the following 3 groups according to the standpoints of study.

1) Have tumors nerve elements?
   Can the nerve grow in neoplasms?
2) Has the nerve any influence on the growth of tumors?
3) Have tumors any influence on the nerve?

Most of studies on these problems were done on maligmant tumors and only a few on benign tumors.

Concerning (2) and (3), there is no reports on benign tumors.

Nerve element was found in myoma of the uterus, lipoma, lymphangioma, hemangioma and dermoid cyst by NAKAMOTO (1932, 1924. 1926) and TSUNODA (1927), in polyp of the intestine by AKANUMA (1929), in polyp, myoma, fibroma and lipoma of the intestine by FEYRTER (1951) and in fibroma by TOKORO (1954).

TSUNODA maintained that the nerve exists in benign tumors, but not in malignant ones. MARULLAS (1928). HERZOG (1928), and MUEHLMANN and others (1932) denied the existence of the nerve in benign tumors.

Thus the problem of the nerve in benign tumors has not yet been solved definitely.

The author tried to report his findings on the nerve in benign tumors operatively removed from patients.

MATERIALS AND METHODS

Tumor tissues, which were removed from patients by operation, were fixed in 10% neutral formol solution immediately.

After fixation for more than 6 months, tumor tissues were sliced with freezing microtome into 30 40 μ thick sections. Some of the specimens were

sliced 4 months after fixation and the sections were further fixed for 2 months in order to avoid the difficulty of slicing in summer.

The sections were impregnated with silver by BIELSCHOWSKY's method modified by SETO. For the differentiation of myelinated nerve fibers from the nonmyelinated ones, the myelin sheath staining method of SUGAMO was also applied in the sections obtained from polyp of the intestine and fibroma.

MICROSCOPIC OBSERVATIONS

I. Epithelial benign tumors

1. Polyp of the stomach

3 cases of polyp of the stomach were studied, one of them was an adenomatous polyp composed of cylindrical epithelium arranged in a single layer with narrow stroma.

In this specimen, any nerve element was not observed. Other two cases were adenomatous polyps with finger shape. The stroma with relatively many blood vessels was located at the center, which was surrounded by the adenomatous tissue as observed in the former case.

In these two cases, large networks consisting of a great number of nerve bundles were observed along the vessels (Figs. 1, 2, 3, 4).

Within the networks the nerve cells with a light cytoplasm were found in places surrounded by a few accessory cells (Figs. 5, 6).

A nerve bundle was mainly composed of fine nerve fibers accompanied with a few thick fibers. It had many SCHWANN's nuclei on its undulated course (Figs. 2, 4). Around the vascular vessels in the stroma, there were terminal nervous networks (STÖHR) with neurofibrils and SCHWANN's nuclei (Fig. 4).

In the narrow stroma between adenomatous structures, seldom appeared a nerve fiber running alone, but the terminal network was not observed (Fig. 7-a, b).

The argyrophile cells were interposed in the glandular arrangement of tumor cells.

2. Polyp of the rectum and the anus

The author observed 8 cases which were divided into 2 groups.

1st group : polyps grown out of the lower end of the rectum or out of the anus. 5 cases belonged to this group.

Every polyp was covered with the squamous epithelium and its stroma was occupied with a large quantity of fibrous tissue. It took a finger-shaped appearence.

1 case had partly glandular structure consisting of a simple columnar epithelium.

It was encountered that the covering of polyps exhibits papilla in various degrees, and the papilla were markedly deep in one case.

2nd group : 2 cases belonged to this group, tumors arose from the mucous epithelium proper to the rectum.

The cortical portion of polyps consisted of simple columnar epithelium

arranged in a glandular structure.

1 case was dominated by an adenomatous structure with poor stroma.

No nerve element was observed in this specimen.

Two other cases had the central stroma connected with the mother tissue.

The nerve in the 1st group :

At the neck of polyp, many of the nerve bundles were found with the blood vessels.

They had many SCHWANN's nuclei and both thick and fine nerve fibers which took same course as the blood vessels parallel to the longitudinal axis of polyp. The nerve bundles formed large networks exchanging nerve fibers each other. There were a few nerve cells, which seemed to be immature (Figs. 8, 9, 10, 11, 12, 13).

The more peripheral was the part of polyp, the smaller became the caliber of a nerve bundle, and the larger the network as well. Gradually they diverged into the connective tissue.

In the periphery, there were fine nerve fibers with many SCHWANN's nuclei and thick ones with a few SCHWANN's nuclei (Figs. 17, 20).

Near the blood vessels and in the subcutaneous tissues, there were found terminal nervous networks with neurofibrils, argyrophile granules, vacuoles and SCHWANN's nuclei, which suggested that the nerve elements were in the intimate relation to the blood vessels (Figs. 15, 16, 17). The terminal nervous networks with a thick nerve fiber, which may possibly be sensory in nature, were observed just beneath the epithelium (Figs. 14-a, b, 18 19, 20).

Many of thick nerve fibers in these bundles were myelinated and diverged into the mucous and submucous tissue gradually, and a few of them were found to end there in ramified or simple tapering ending (Figs. 20, 27-a, b).

The case which showed a marked formation of papilla, had glomerular sensory endings in various shapes near the papilla, though they were small in number (Figs. 21-28).

The nerve in the 2nd group :

In the stroma, there appeared the same nerve bundles with a small number of nerve cells as those in the 1st group.

The thick nerve fibers, the visceral sensory nerve SETO, were observed, too (Figs. 29, 30).

The thick nerve fibers in a nerve bundle were less in number comparing with those in the 1st group.

The terminal nervous networks were seen near the blood vessels like the 1st group, but the nerve element was not found in the narrow stroma of adenomatous structures.

Among the glandular arrangement of tumor cells, argyrophile cells were observed.

3. Median cyst of the neck

Just beneath the stratified epithelium there appeared the nerve bundles which extended to the basis of the epithelium (Figs. 33, 34, 35, 36, 37).

4. Nasal polyps

3 cases were observed, but no nerve element was there.

5. Subcutaneous cysts (Epidermoid)

No nerve element was found in 3 cases.

II. Nonepithelial tumors

6. Fibroma

A case of fibroma grown out of the fascia of the striated muscle was observed.

In some part of tumor, a great number of the nerve bundles ran parallel with each others (Figs. 38, 39). Gradually diverging finally they came into one or two fibers, which took more or less undulated courses. They had spindle-shaped expansions in places. A small number of SCHWANN's nuclei were found along the course of these nerve fibers.

These nerve elements coursed along the blood vessels or distributed between tumor cells. They were all non-myelinated fibers (Figs. 40, 41, 42). A greater part of tumor had no nerve distribution.

7. Mixed tumor of the parotid gland

In this case nerve elements were not observed except a mass of fibers looking like an oblique section of a nerve bundle (Figs. 43, 44).

8. Myoma of uterus ..... 1 case
9. Fibro-lipoma ..... 1 case
10. Fibro-adenoma ..... 1 case

No nerve element was observed in these 3 cases.

III. Other tumors

11. Dermoid cyst of ovary ..... 2 cases

The hairs grew out of the inner surface of the tumor.

The wall of the tumor was thickened in this part, the surface of which was covered with stratified squamous epithelium. Beneath the epithelium there were many hair follicules with piloerector muscles, sebaceus glands, sweat glands, connective tissues, fat tissues, fibrous cartilage, gland like tissue, groups of pigmented connective tissue cells and various sized blood vessels.

Nerve ending in the skin was not found. Just beneath the skin, a small number of nerve bundles were observed in places.

They were composed of fine nerve fibers and SCHWANN's nuclei. In most of hair follicules, nerve elements were not found, but a few of them had thick nerve fibers in a bundle and the isolated nerve fibers running in circular direction closely around the follicules (Fig. 45).

There were also some nerve bundles consisting of fine nerve fibers with a great number of SCHWANN's cells (Fig. 46).

Most of the sebaceous glands had no nerve element except a few which had the nerve fibers with many SCHWANN's nuclei and nervous syncytia with neurofibrils (Figs. 47, 48).

The sweat glands and its couduit:

Almost all sweat glands had no nerve elements, but a few of the glands had terminal nervous networks near or in contact with themselves, which seemed to innervate the small blood vessels as well as the sweat gland (Figs. 49–53).

There were terminal nervous networks between the smooth muscle fibers of the piloarrector muscles (Fig. 54).

Between the fat tissues some nerve bundles with fine fibrils and SCHWANN's nuclei were found in places (Figs. 55–57). Some terminal nervous networks innervated the fat cells as well as the blood vessels (Figs. 58–61).

In the connective tissue, there were a great number of nerve bundles and terminal nervous networks (Figs. 62–69).

The fibrous cartilage had many nerve fibers running separately in undulated course. These nerve fibers accompanied only few SCHWANN's nuclei (Figs. 72, 73.)

The groups of the pigmented connective tissue cells were founnd here and there. Each group had nerve fibers running separately (Fig. 71).

Near the blood vessels in various sizes, the terminal nervous networks were always observed (Figs. 74–78). Within the gland like tissues there was no nerve element.

DISCUSSION

26 cases of benign tumors were studied and the author found nerve elements in 13 cases of them : in 10 cases of 18 epithelial tumors, in 1 case of 5 nonepithelial tumors and in 2 cases of other 3 tumors.

In 18 cases of epithelial tumors, the nerve elements were found in 2 of 3 stomach polyps, in 7 of 8 ano-rectal polyps, in a median cyst, in none of 3 nasal polyps and 3 subcutaneous epidermoids.

In cases of nonepithelial tumors, the nerve elements were observed in 1 case of fibroma and none in the other 4 cases (a myoma of the uterus, a fibrolipoma, a mixed tumor of the parotid gland, and a fibroadenoma).

In 3 cases of other tumors, the nerve elements were found in 2 cases of dermoid cyst of ovary and not in a dermoid of eye lid. Polyps of the stomach and of the rectum except those grown out of the anorectal portion had the same histological structures, the nerve elements of which showed almost the similar figures in both of these tumors ; nerve cells and terminal nervous networks around the vascular vessels, but they were not observable in the narrow stroma between gland-like structures. Only the difference between both tumors were that the polyp of the rectum had more number of thick nerve fibers in a bundle than the polyp of the stomach. This may be due to the histological difference of MEISSNER's plexus between the rectum and the stomach.

The polyps grown out of the lower end of the rectum or out of the anus had almost the same figures of nerve elements comparing with polyps of the upper rectum, except that the formers had almost no nerve cells and had many sensory nerves with simple ramified or non-ramified endings in cutanaeous tissue

and glomerular endings in the subcutaneous tissue.

These glomerular endings had a special nucleus at the center and a capsule of the connetive tissue covering them. Regarding the structures, they may be the I. II. and III. type genital sensory bodies by DOGIEL (1893). The existence of the genital sensory bodies in the anus is described by SETO.

FAN and LEE observed no nerve element in polyps of the stomach and rectum which had a pure adenomatous structures. HERZOG (1928), M. MUEHLMANN and M. KURBANALIEW (1932) denied the nerve elements in the polyp of the intestines, while AKANUMA (1930) demonstrated the nerve bundles and sensory nerve endings in ramified form. FEYRTER (1931), too, described the nerve bundles and the nerve cells in the stroma of the same polyps. It was the HERZOG's opinion that a polyp consisted of the proliferated epithel cells. The nerves, though he found in the subcutaneous tissue, were not regarded as the proper nerves of polyp since they did not reach the epithel.

FEYRTER described his view that polyps of the alimental canal must be regarded as the proliferation of the all elements of the mother tissues and they give different histological figures due to the proliferated tissues in various degrees. Agreeing with FEYRTER's opinion, the nerve plexus, the nerve cells the sensory nerves and the sensory nerve endings are similar to the nerve elements of the mother tissues and they can be regarded as the intrinsic nerves belonging to the tumor tissues. The glomerular sensory ending observed in an anal polyp may be the first description by the present author.

FEYRTER reported that he found the vegetative nerve network in the narrow stroma between the glandular structures of polyp by means of enclosure tartaric acid thionin staining (Weinsteinsäure-thionin Einschluss-färbung). However, the author could not find it in the silver impregnated specimens. Some nerve fibers running separately in the tissue just beneath the glandular structure of gastric and rectal polyps must be regarded as the sensory nerves by SETO.

As far as the nerves of fibroma were concerned, M. MUEHLMANN denied the existence of them, whereas FEYRTER described the terminal nervous network proper to the blood vessels in it and TOKORO (1954), too, reported that he found a great number of nerve elements.

The author found the non-myelinated nerve bundles and the isolated nerve fibers in fibroma. Some of the isolated nerve fibers took their courses along the capillary blood vessels and others were distributed between tumor cells separately from the course of the blood vessels.

On the existence of the nerve elements in the dermoid cyst of the ovary, there are reports by NAKAMOTO and TSUNODA, however, they did not describe in detail. In 2 cases, the author found abundant nerve fibers in almost all tissues of the tumors.

Almost normal nerve fibers and the terminal nerve networks were found in each tissue and organ, some of which received nerves abundantly while others poorly or not. The connective tissue, the fat tissue, the blood vessels, the

sebaceous gland and the sweat gland receive the terminal nerve networks.

A part of the fat tissue and sweat glands had the terminal nerve networks around them, which, as STOEHR described, innervated the blood vessels as well.

The sensory nerve ending in the skin was not observed, but the sensory nerves were clearly demonstrated closely around the hair follicules.

The nerve cell in the dermoid cyst of the ovary was not observed by the author.

NAKAMOTO, who regarded the nerve fibers in dermoid cyst as the tissue grown out of the aberated mixed embryonic germs, could find no nerve cell in it.

If it is sure that a dermoid cyst has no nerve cell, the nerve fibers in the tumor must be regarded as ovarial origin, because the aberration of the nerve fiber alone without the nerve cell cannot be considered. The author considered that the nerve fibers in the dermoid cyst came along the blood vessels out of the mother tissue, i. e, the ovary. They may adapt to each organ or tissue, but remaine in imperfect development. According to SATO, the ovary has not only the vegetative nerves but the myelinated sensory nerves. Therefore, the sensory nerves in the tumore can be recognized as ovarial origin.

However, it is possible, there are some nerve cells so young that one cannot recognize them as nerve cells.

The present author could not find the nerve fiber in one case of myoma of the uterus, while NAKAMOTO reported that myoma of the uterus always had the nerve element. The author had no case of such benign tumors as lipoma, lymphangioma and hemangioma in which the nerve element was found by NAKAMOTO and TSUNODA. In regard to the existence of the nerve element in tumors, GREEN and MARSCHALL, BORST, RIBBERT, AKAMATSU, ENGEL and FISCHER WASELS, GOLDMANN and HERZOG denied the nerve of the tumor.

TSUNODA and NAKAMOTO reported for the first time that benign tumors had nerve elements, while malignant ones had none.

However, the number of tumors and their sort in the study, were too small to maintain that all benign tumors have the nerve.

In the author's cases, some kinds of benign tumors had no nerve element, while in a certain kind of tumor, some had the nerve and others none, thus, benign tumors have the nerve element with some exceptions.

IIHARA has recently studied the evolution of the peripheral nervous system in rabbits and lead very interesting results as follows:

(1) The nerve supply of the hair follicules in the ear appears first on the 15th day after birth.

(2) Nervous syncitia are found first in the later fetal stage and become mature in 2nd month.

(3) Nerve cells in the wall of the intestine appear already in the late fetal stage. They become mature in the 2nd month.

The nerve supply to most of the hair follicules in dermoid cyst was very poor or absent. A considerable development of nervous syncytia was observed

near tthe blood vessels and other parts of tumors, but it was poorer in other parts.

Nerve cells found in polyps grown out of the stomach and the rectum had only a few accessory cells around them and the development of the neurites was scarcely observed. These findings show that the nerve elements in benign tumors are immature in the ontogenic point of view.

Conclusion

The author have studied 26 cases of benign tumors and reached the following conclusion:

(1) The nerve elements were observed in polyps of the stomach, the rectum, and auus, and in a fibroma, a median cyst of the neck and dermoid cysts of the ovary.

(2) Not all benign tumors had nerve elements, and not all the same kinds of tumors had those.

(3) In the stroma of polyps in the stomach and the rectum nerve cells, networks of nerve bundls and nervous terminal networks similar plexus were observed.

(4) There were found the sensory nerves SETO in polyps of the stomach and the rectum.

(5) In polyps of the stomach and the rectum there were observed many myelinated nerve fibers except vegetative ones, and in polyps of the lower end of the rectum and the anus non-ramified and simple ramified sensory nerve endings and glomerular endings of all types of the genital sensory bodies (DOGIEL) were observed.

(6) In agreements with FEYRTER's opinion that polyps of alimentary canals were the proliferation of mother tissues, regarded the author that the neve elements found in polyps belonged to the tumor.

(7) In the median cyst of the neck there were nerve fibers ending in the epithelium.

(8) Unmyelinate nerves found in a fibroma diverged into the tumor tissue and at last isolated nerve fibers run along the capilary blood vessels or alone between tumor cells.

(9) In the dermoid cyst of ovary there were observed many almost normal nerve elements adapting to each organ or tissue, but in large parts of the tumor the development of nerve element was poor or inperfect. The author observed the nervous terminal networks of almost normal figure near the blood vessels, sweat glands and fat tissue, which seemed to innervate blood vessels as well.

(10) No nerve cell was observed in the dermoid cyst, so he regarded that the nerve elements in the tumor originated from the mother organ (ovary).

(11) The nerve elements in benign tumors remained immature in the ontogenetic point of view.

I wish to express my heartfelt thankfulness to Dr. Ch. Kimura for giving many advices and kind guidance throughout present experimentation.

Polyp of the stomach. Figs. 1—7.

Fig. 1 Nerve bundles in the stroma 10×15
Fig. 2 Nerve bundles in the stroma 20×15
Fig. 3 Nerve bundles and a nerve cell with a few accessory cells 10×15
Fig. 4 Terminal networks near the blood vessels
Fig. 5 Nerve bundles and a nerve cell with a few accessory cells 40×15
Fig. 6 2 nerve cells with a few accessory cells 40×15
Fig. 7—a Sensory nerve fiber (Seto) 40×15 **Fig. 7—b** A sketch of Fig. 7—a

Polyps of the rectum and the anus (I. groud) Figs. 8—32

Fig. 8 A complicated figure in the neck of a tumor. Blood vessels, nerve bundles (vegetative and sensory) and nervous terminal networks are seen. 10×15
Fig. 9 A part of Fig. 8, enlarged. 20×15
Fig. 10 Nerve bundles and blood vessels in the stroma. 10×15
Fig. 11 A large network of nerve bundles. 10×15
Fig. 13 Two nerve cells with a few accessory cells and nerve bundles. 20×15
Fig. 14—a A thick sensory nerve fiber within the terminal network. 90×15. **Fig. 14—b** a sketch of Fig. 14-a.
Fig. 15 A terminal network innervating blood vessels. 20×15
Fig. 16 A part of the Fig. 15, enlarged. 90×15
Fig. 17 Nerve fibers along a small blood vessel. 20×15
Fig. 18 A terminal network, in which a sensory nerve fiber runs. 20×15
Fig. 19 〃 〃 20×15
Fig. 20 A sensory nerve fiber out of a sycytium of Fig. 19 and 18 ending in the epithel layer.
Fig. 21 Two glomerular sensory endings.
Fig. 21—Fig. 28 Glomerular sensory endings (Genital sensory bodies (DOGIEL).
Fig. 22 A genital sensory body (DOGIEL) III. type. 20×15
Figs. 23—25 Dogiel III. type genital sensory corpuscles.
Figs. 26 and 27 A DOGIEL I. type genital sensory body and ramified endings in the epitheliar layer. 20×15
Fig. 28 A genital sensory body (DOGIEL II. type) polyps of the rectum of II. group.
Fig. 29 A sensory nerve fiber running for the adenommatous layer. 10×15
Fig. 30 A part of Fig. 29 enlarged. 20×15
Fig. 31—a, b and 32 Nerve cells in the stroma 10×15

Median cyst. Figs. 33—37.

Fig. 33 A nerve bundle beneath the epithel layer. 20×15
Fig. 34 A sensory nerve fiber running for the epithelium. 20×15
Fig. 35 Sensory nerve fibers near the epithelium. 20×15
Figs. 36 and 37 Nerve bundles beneath the epithel layer. 40×15

Fibroma Figs. 38—42.

Fig. 38 Parallel running nerve bundeles. 20×15
Fig. 39 Nerve bundles.
Fig. 40 Nerve fibers running along a blood vessel. 40×15
Fig. 41 Nerve fibers running along a blood vessel. 90×15
Fig. 42 A nerve fiber with two SCHWANN's nuclei running between tumor cells, which shows spindle shaped expansions. 90×15

Mixed tumor of the parotid gland. Fig. 43—44.

Figs. 43—44 Oblique section of nerve bundles? 40×15

Dermoid cyst of the ovary. Fig. 45—81

Fig. 45 Sensory nerve fibers around a hair follicule 20×15
Fig. 46 Nerve bundles around a heir folicule and sebaceous glands. 20×15
Fig. 47 A nerve bundle running to the sebaceous glands. 20×15

Fig. 48 A nervous syncytia of the sebaceus glands. 90×15
Figs.49—52 Terminal networks of the sweat glads 40×15, 90×15, 90×15, 90×15
Fig. 53 Terminal networks of a couduit of the sweat gland. 40×15
Fig. 54 Terminal networks between the piloarrector muscle cells 90×15
Figs.55—57 Nerve bundles in or near the fat tissue. 10×15, 10×15, 20×15
Fig. 58—a, b Terminal networks innervating the fat tissue cells and blood-vessels. 20×15
Figs.59—61 A part of Fig. 58 enlarged. 90×15
Fig. 62 Nerve bundle in the connective tissue. 40×15
Figs.63—65 Terminal network in the connective tissue. 20×15, 40×15, 40×15
Fig. 66 Terminal networks in the connective tissue. 20×15
Fig. 67 The left end of terminal networks of Fig. 66. 90×15
Fig. 68 The middle part of terminal networks of Fig. 66. 90×15
Fig. 69 A lower branch of the syncytium in Fig. 66. 90×15
Fig. 70 An isolated nerve fiber in the connective tissue. 20×15
Fig. 71 A nerve fiber between pigmented cells. 90×15
Figs.72 and 73 Nerve fibers in the fibrous cartilage. 20×15
Fig. 74 Terminal networks innervating the blood vessels. 20×15
Fig. 75 A part of Fig. 74. 90×15
Fig. 76 A part of Fig. 74. 90×15
Fig. 77 Terminal networks of a precapillary blood vessel. 90×15
Fig. 78 // // //

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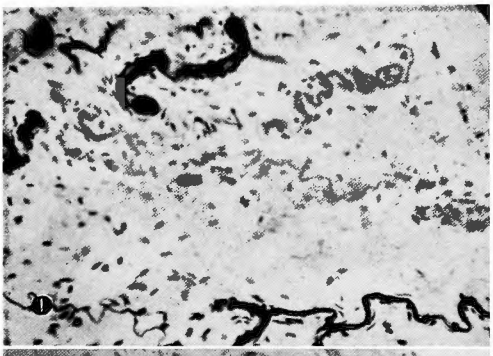
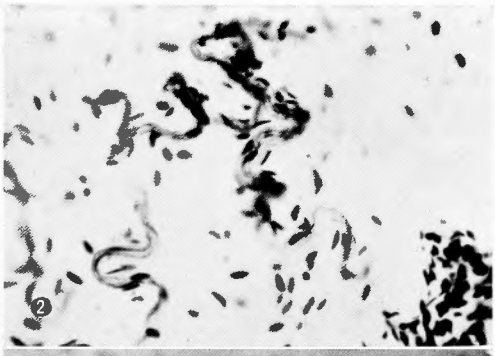
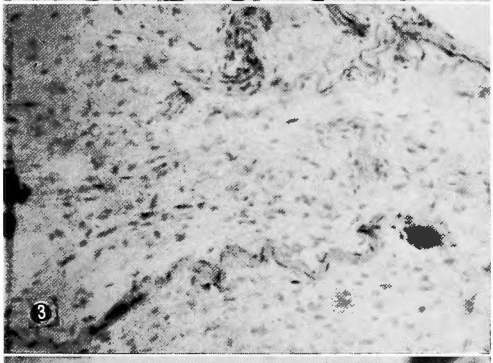
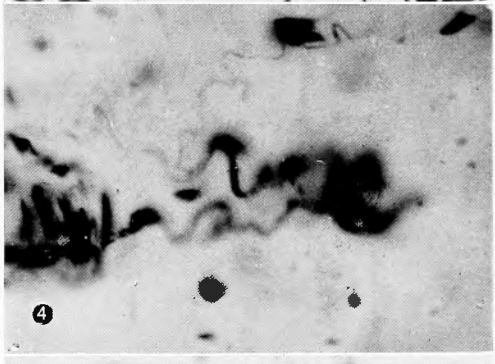
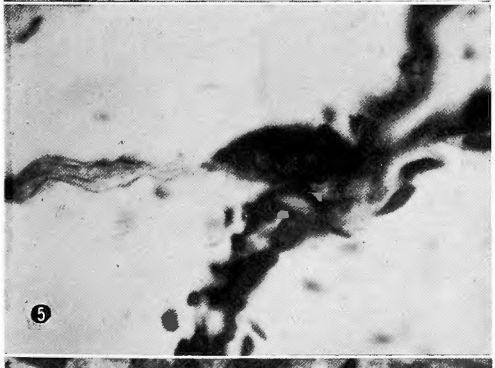
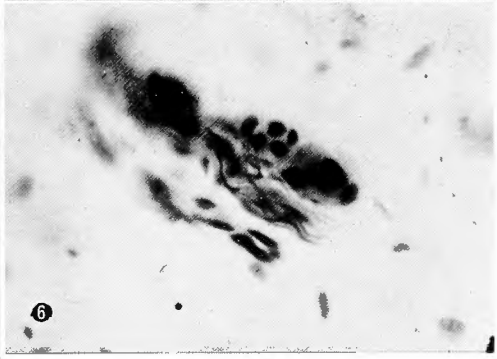


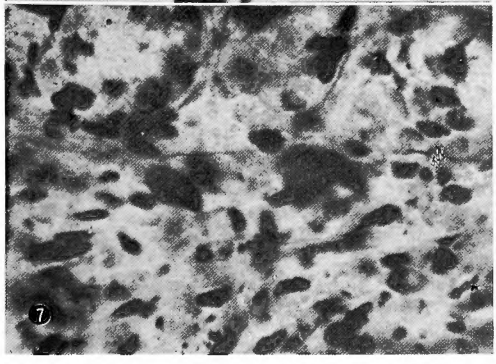


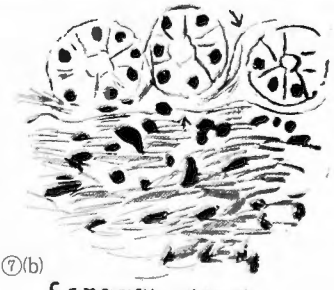






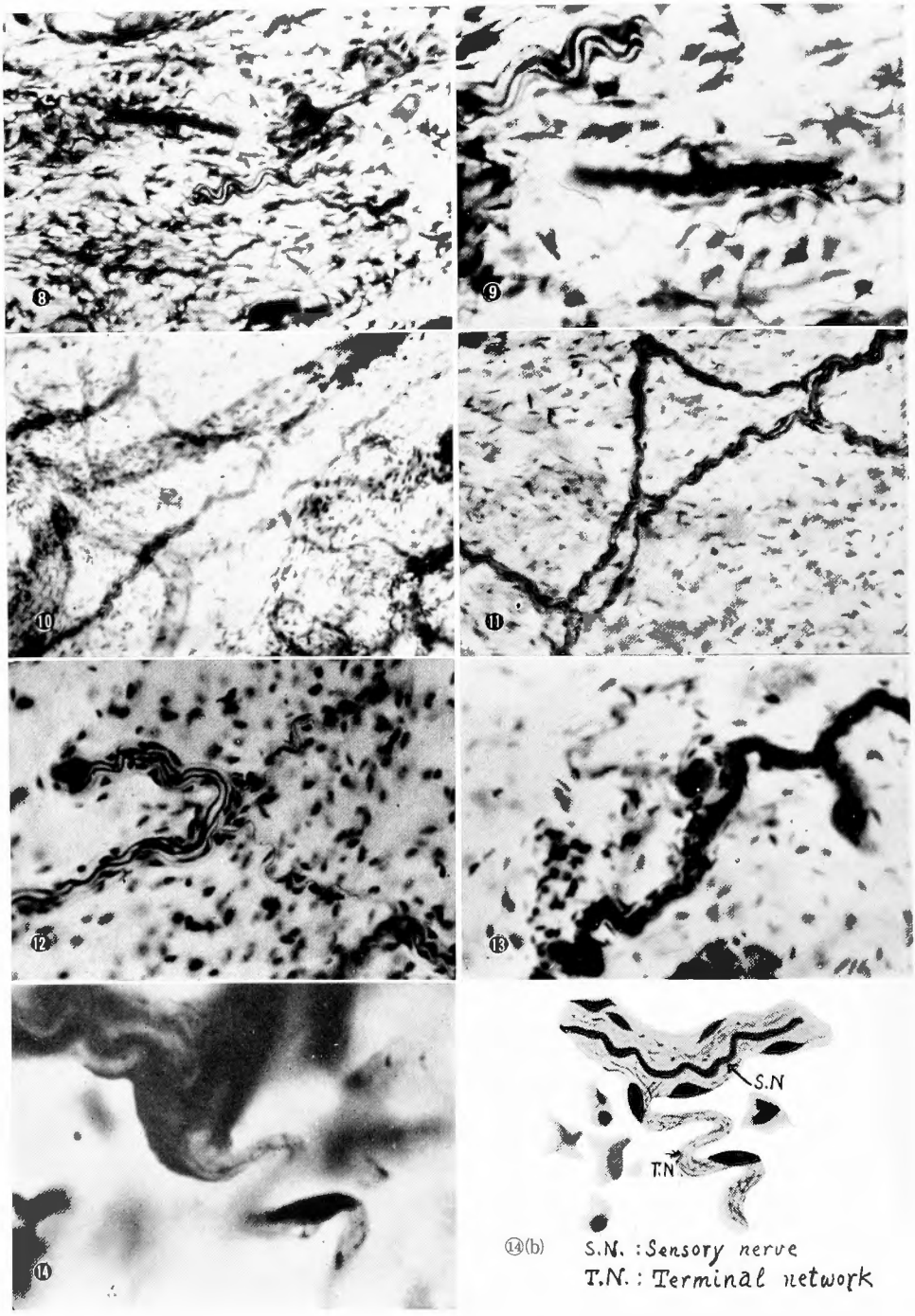




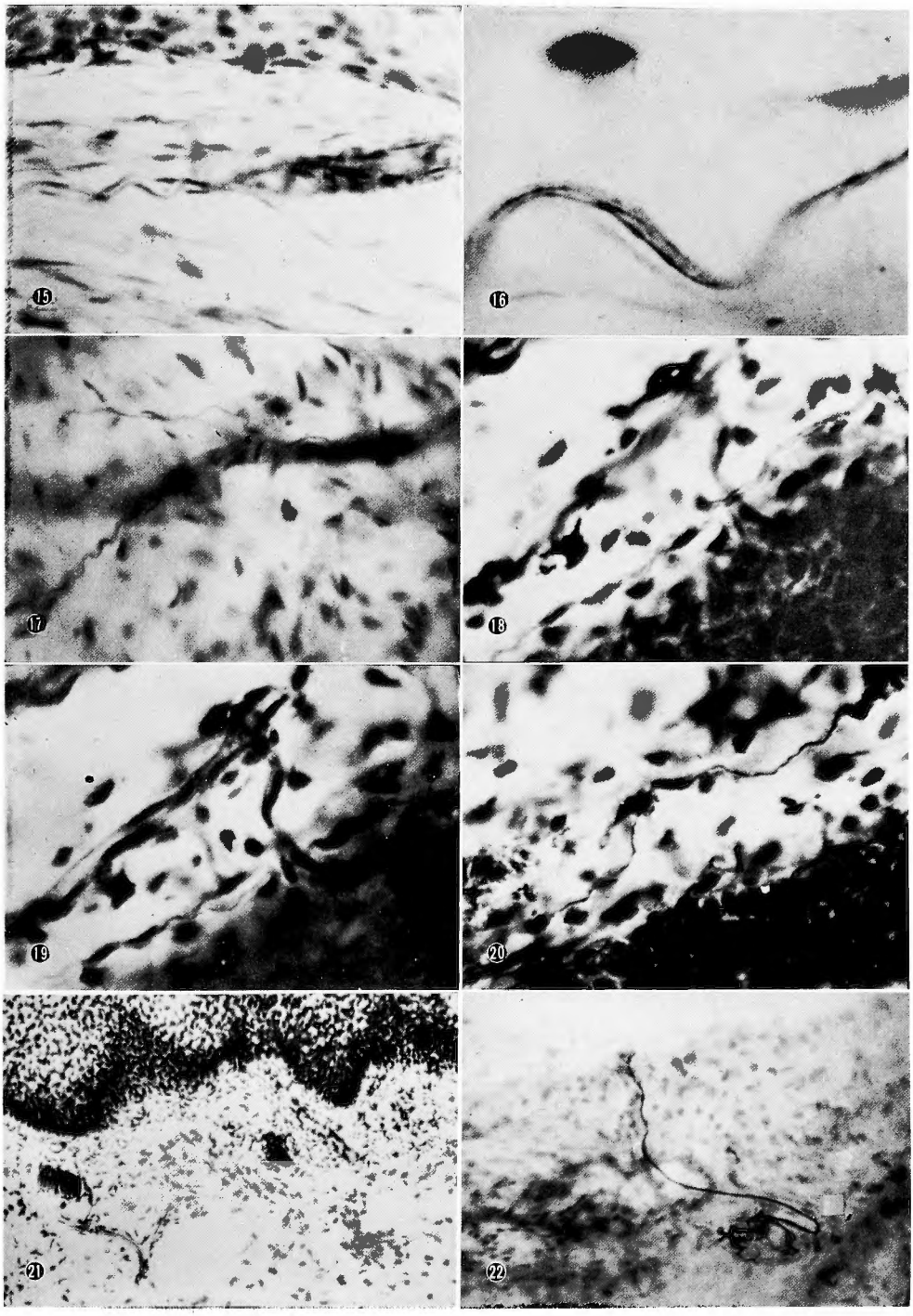


⑦(b)

Sensory nerve fiber Seto



⑭(b) S.N. : Sensory nerve
T.N. : Terminal network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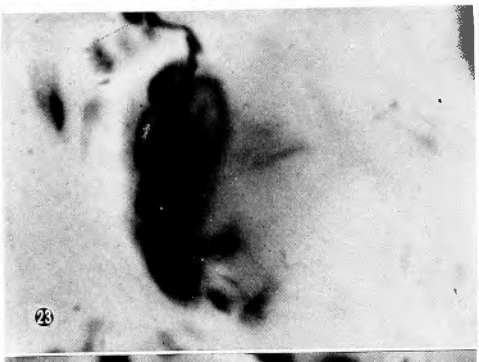
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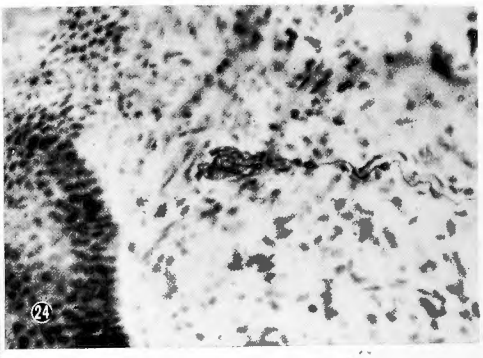
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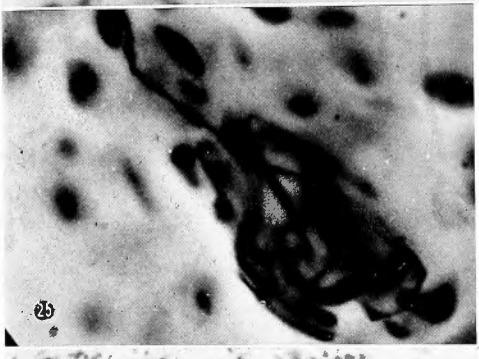
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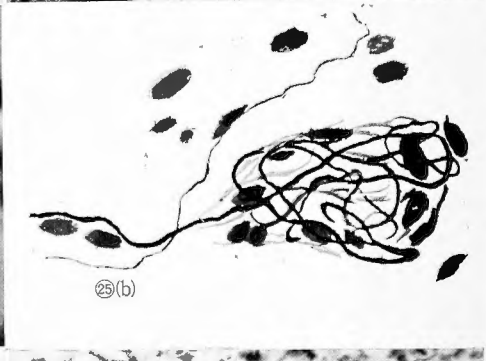
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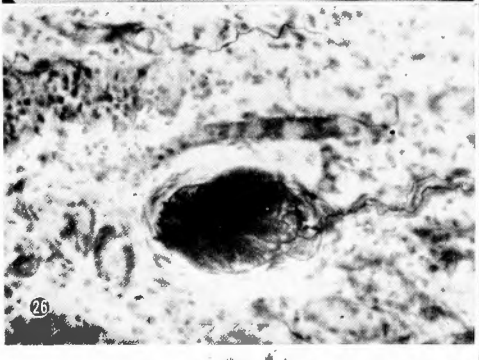
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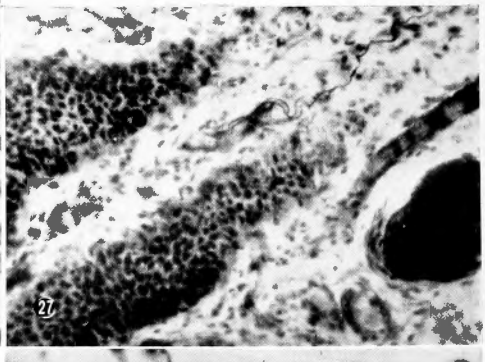
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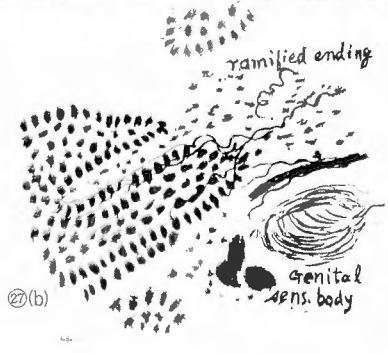

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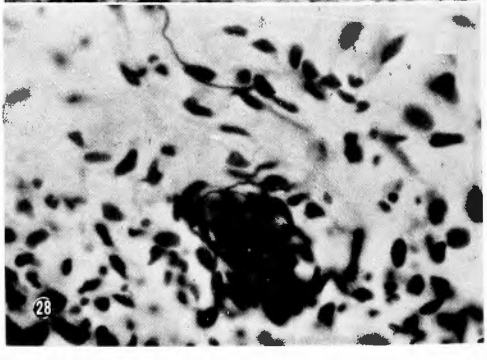
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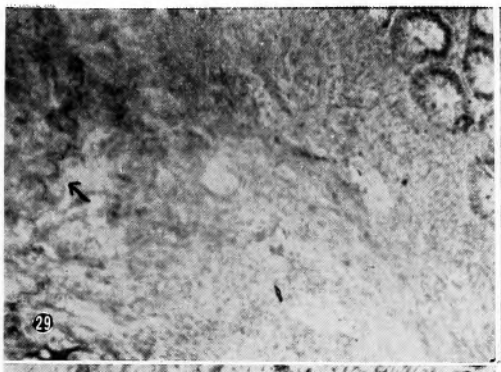
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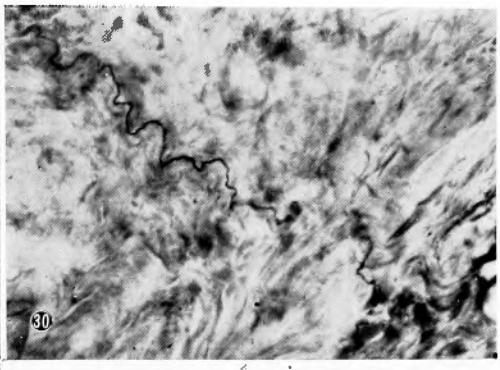
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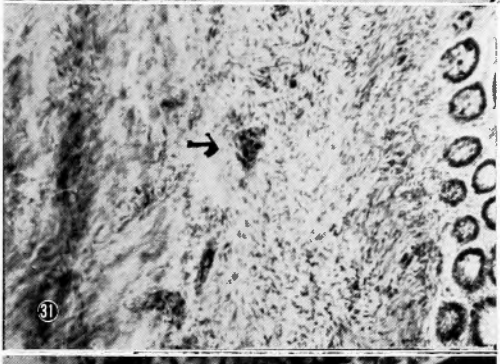
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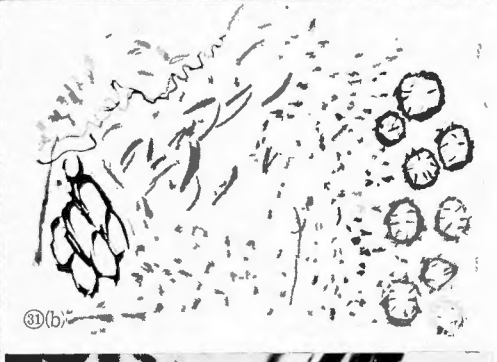
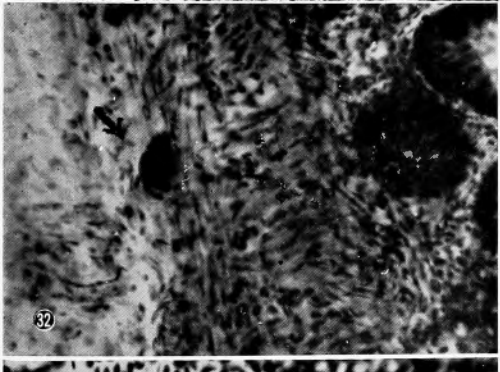

31(b)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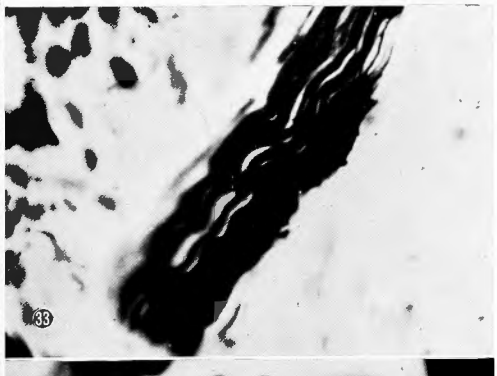
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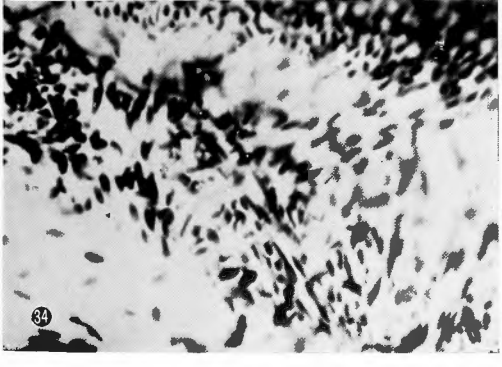
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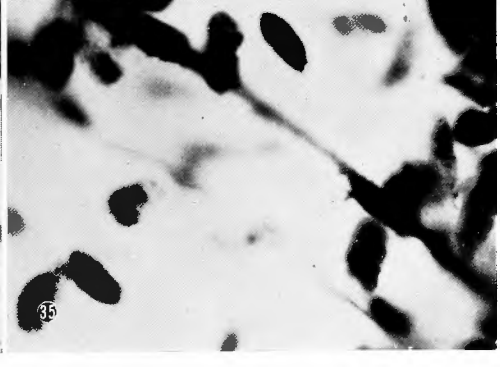
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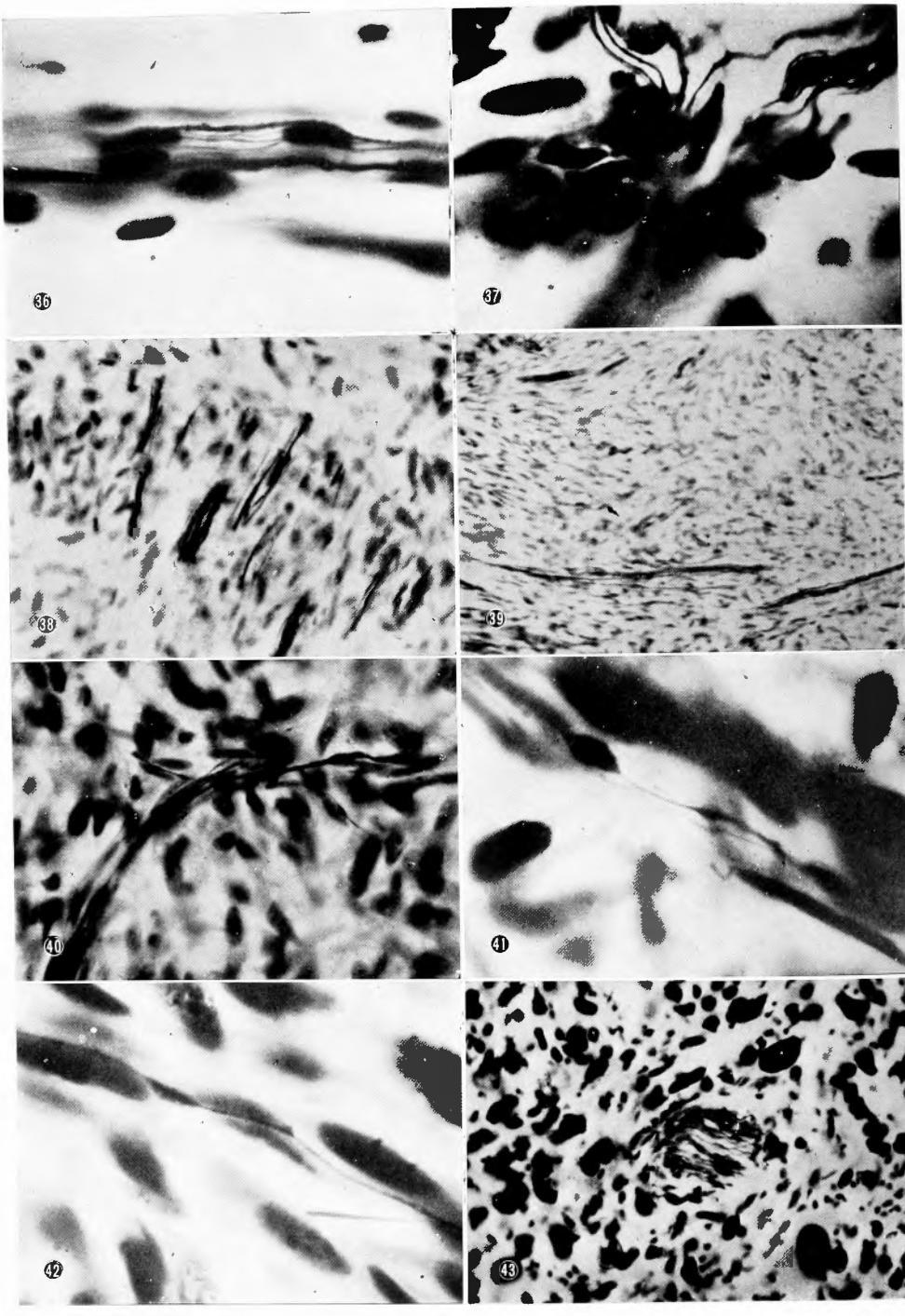

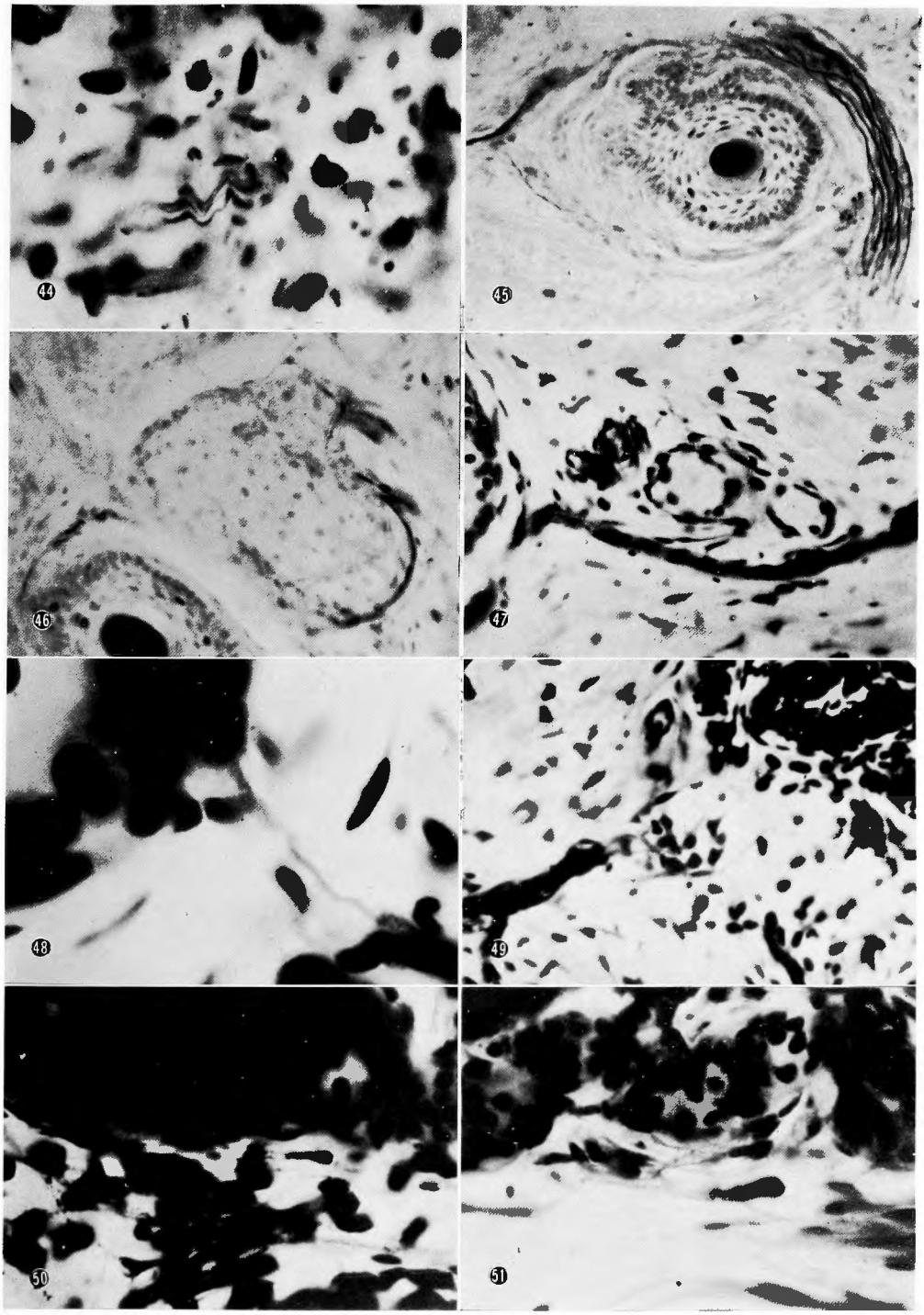
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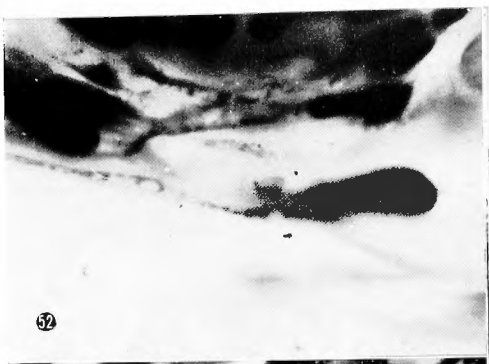
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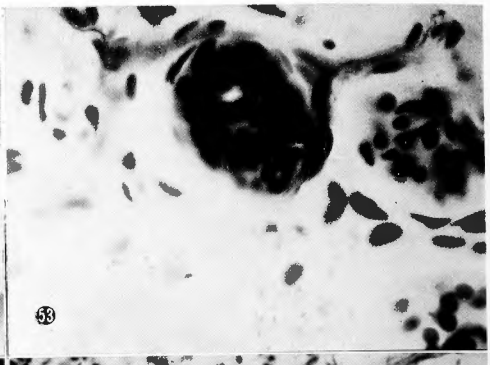
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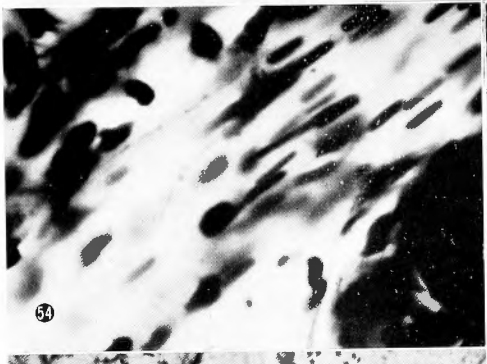
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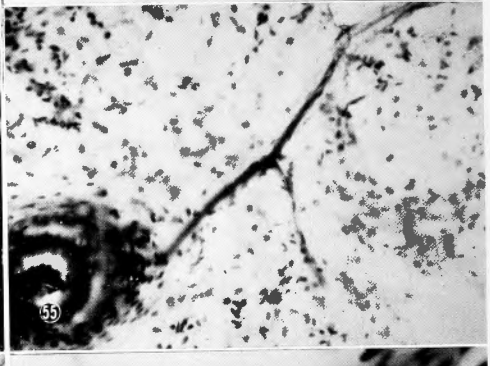
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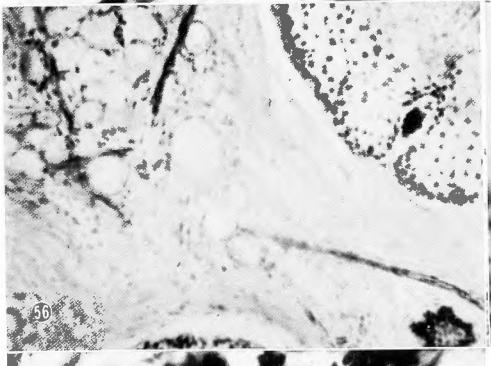
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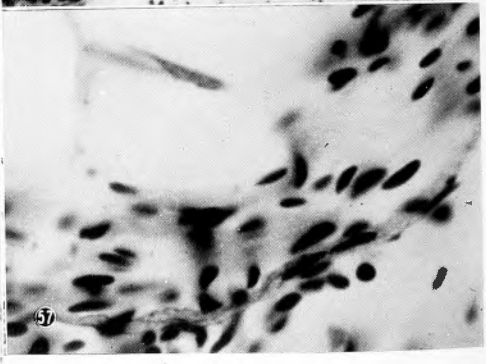
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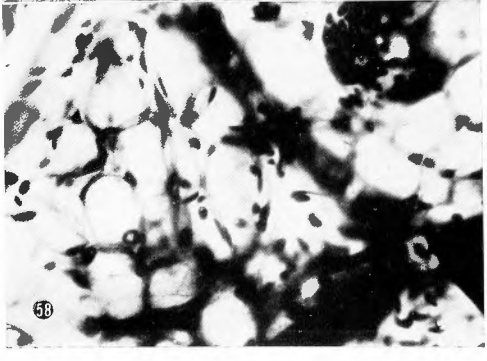
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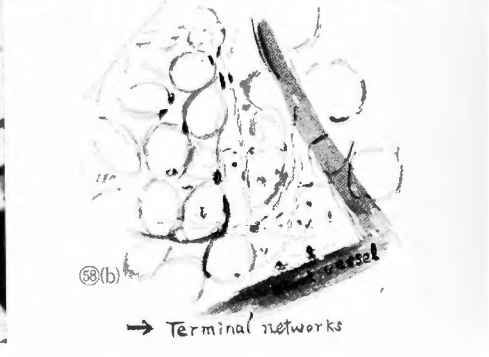
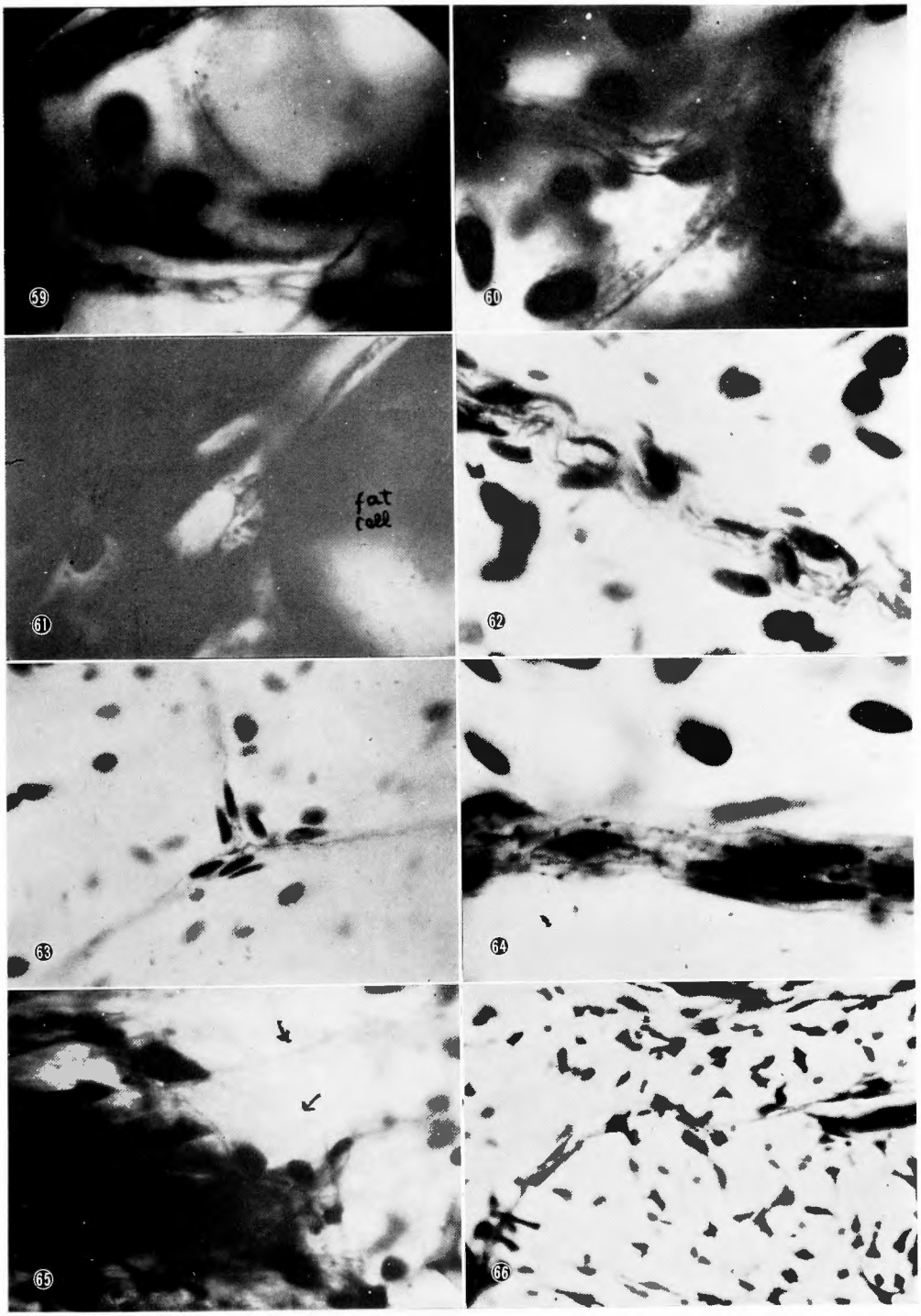

58(b)
→ Terminal networks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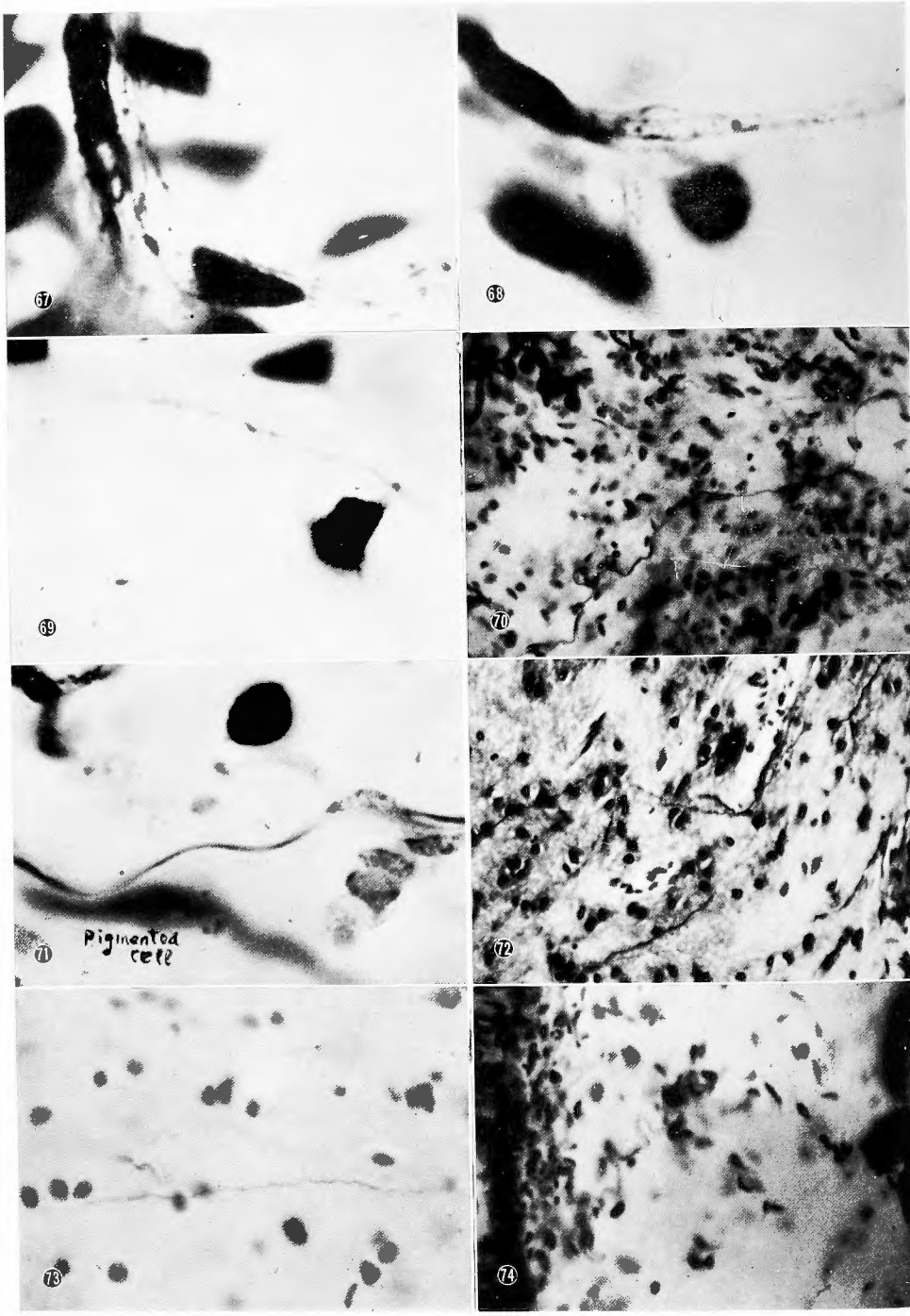
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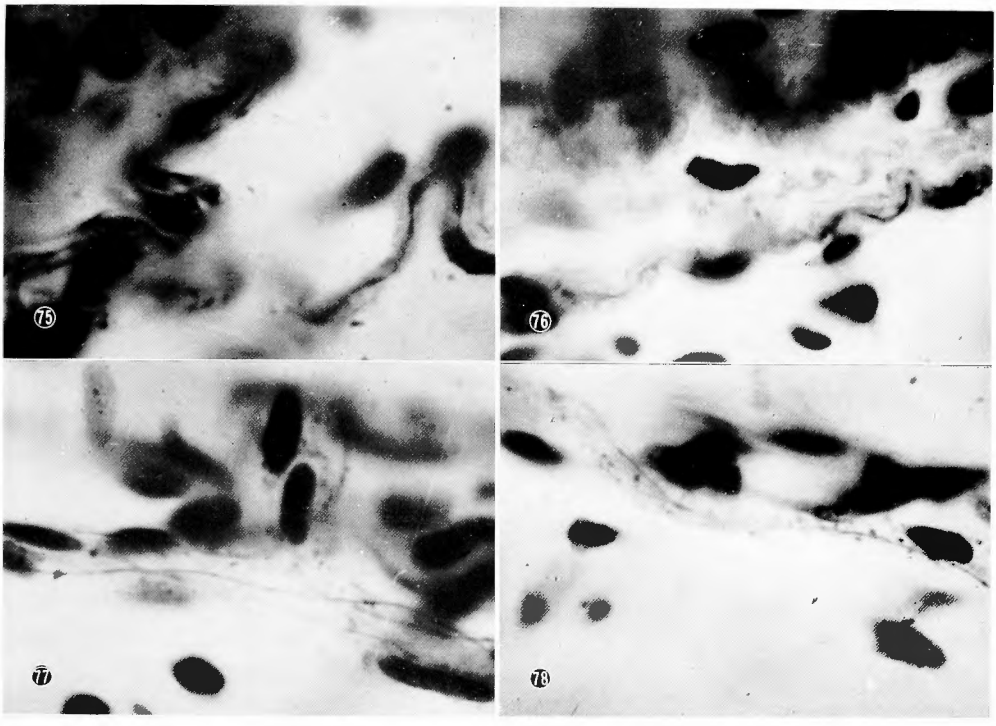
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和文抄録

良性腫瘍の神経組織学的研究

京都大学医学部外科学教室第2講座 (指 導：青柳安誠教授)

高知県仁淀病院 (院長・吉野 位)

吉 野 位

26例の良性腫瘍に就いて腫瘍内神経の存在，神経の組織学的性状，起源等を組織学的に検索した結果，18例の上皮性腫瘍中10例，5例の非上皮性腫瘍中の1例，及びその他3例の腫瘍中2例に神経要素の存在を確認し次の如き結論に到達した．

1）胃ポリープ，直腸及び肛門部ポリープ，線維腫，正中頸部嚢腫及び卵巣皮様嚢腫に神経要素の存在を立証した．

2）良性腫瘍内に神経要素を認め得るものもあるが総てに証明し得るわけではなく，又同一腫瘍に於ても総て神経を有するとは限らない．

3）胃及び直腸上部のポリープ内間質中にはマイスネル神経叢にみられると同様の神経細胞，神経束及び神経網を認めた．

4）胃及び直腸ポリープ内には知覚神経が存在する．

5）胃及び直腸上部のポリープには自律神経の他に多数の有髄神経線維（知覚性）が存在し，又直腸下部及び肛門のポリープ内には非分岐性，単純游離性終末を有する知覚神経が見出された他に Dogiel の生殖器知覚終末の凡ゆる形のものが証明された．

6）Feyrter は消化器官のポリープは母組織の凡ての部分が増殖して発生すると言つているが，著者は彼の見解に賛意を表し，それ故にポリープ内の神経もまた母組織から発育したものと考える．

7）頸部正中嚢腫内には上皮に終る神経終末を見出した．

8）線維腫内に発見された無髄神経は，腫瘍組織内に分散し，終りに個々の線維は毛細血管に同伴し又は独立の走行を以て腫瘍細胞間に入る．

9）卵巣の皮様嚢腫には腫瘍内各器官及び各組織に適応性を示す多数の神経要素を認めたが，それらの神経構造は甚だ未熟な形をとり，不完全なもつであつた．血管の附近には神経終網が殆んど正常に近い形で存在し，又汗線脂肪等の諸組織中にも同様のものを認めたが，斯る自律神経は血管をも同時に支配するものであろう．

10）卵巣皮様嚢腫内には神経細胞を見出し得ない．夫故神経要素はやはり母組織たる卵巣から来たものと考えられる．

11）良性腫瘍中の神経要素は個体発生の段階からみると未熟なものである．