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**STUDIES ON THE LYMPHONODI OF CATS V.  
LYMPHATIC DRAINAGE FROM THE PERITONEAL AND  
PLEURAL CAVITIES**

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INTRODUCTORY

The principal object of this paper is to ascertain exactly the distinct relations between the mesothelial cavities and lymph nodes.

It is a well-known fact that foreign particles in the peritoneal and pleural cavities are drained away mainly by way of a lymphatic pathway.

There were only a few general anatomical studies of such lymphatic drainage of the cat, which were made by BOLTON and others. As the observations were made on physiological or clinical bases, the anatomical descriptions were simply given. The present writers have examined in more detail the matter of lymphatic drainage in the cat, since this problem seems to require further investigation.

In this paper, moreover, the hole structure of the mediastinum, which permits of communication between the right and left pleural cavities, is described.

MATERIALS AND METHODS

For this research, 30 cats were used, as indicated in table 1.

The cats were anesthetized by ether and injected with a suspension of 50% India ink (Kaimei Co.) in 0.85% NaCl aqueous solution, 1 ml per kg body weight, into the peritoneal and pleural cavities. For injection, use was made of a needle of  $\frac{1}{2}$  mm in diameter, whose point was ground for fear of injury to organs. Injections were made in the 9th or 10th intercostal spaces at the mid-level of the right side into the pleural cavity and from *Linea alba* into the peritoneal one. After 10 minutes to 5 hours, the cats were killed by ether overdosage. Generally, the observations were made with the naked eye or with help of a magnifying glass, but microscopical methods were employed for demonstrations of some structures, such as the structure of the locality absorbing India ink and the hole of the mediastinum.

TABLE 1. *Materials Used for These Observations*

INJECTED INTO PERITONEAL CAVITY				INJECTED INTO PLEURAL CAVITY			
Exp. No.	Sex	Age	Weight (g)	Exp. No.	Sex	Age	Weight (g)
1	♀	6 Days	120	15	♂	1 Day	100
2	♀	6 "	130	16	♂	5 Days	100
3	♂	1.5 Months	390	17	♀	1.5 Months	350
4	♂	2 "	560	18	♂	1.5 "	360
5	♂	4 "	900	19	♂	1.5 "	400
6	♀	4 "	1,100	20	♂	2 "	350
7	♂	8 "	1,400	21	♀	3 "	600
8	♀	9 "	3,400	22	♀	3 "	700
9	♀	10 "	2,420	23	♂	4 "	1,200
10	♀	1 Year	1,850	24	♂	10 "	4,500
11	♀	2 Years	2,550	25	♀	1 Year	1,750
12	♂	3 "	3,800	26	♂	1 "	3,200
13	♀	8 "	2,400	27	♀	3 Years	2,500
14	♀	10 "	3,200	28	♂	3 "	2,700
				29	♂	3 "	3,500
				30	♂	5 "	4,300

## RESULTS

## 1. Positions Absorbing India Ink

In the cases where the ink was injected into the peritoneal cavity, the ink adhered on the diaphragmatic peritoneum and omentum.

In the diaphragm, the ink drew a diffuse fine lattice as absorbed into the peritoneum; most conspicuous in *Pars sternalis* and *costalis*, moderate in the central tendon and less conspicuous in *Pars lumbalis*. Numbers of lymphatic vessels containing the ink appeared under the diaphragmatic pleura.

In the greater omentum, the ink was adherent largely, but no lymphatic vessels colored by India ink were found, and nodes related with vessels of the omentum did not include the ink.

The other visceral and parietal peritonea were never colored by the ink.

In the cases where the ink was injected into the pleural cavity, the ink adhered on the costal pleura and mediastinum.

In the costal pleura, the ink was mainly absorbed into the caudal and ventral costal pleura on which it drew delicate lattices.

In the mediastinum, the ink may probably be absorbed in the caudo-ventral portion, where the ink was conspicuously adherent.

Lymphatic vessels colored by the ink appeared along *V. thoracica interna* beneath

*M. transversus thoracis*, along *A. and V. intercostalis* and along the lateral border of *M. quadratus lumborum* in the thoracic cavity. In a few cases, a fine lymphatic vessel was found along a pericardial and diaphragmatic ramus of *V. thoracica interna*.

Other pleurae, such as the pleura of the lung and diaphragm, were never colored by the ink.

In short, the ink injected into the peritoneal cavity may be first drained away by way of the diaphragmatic peritoneum. The ink injected into the pleural cavity may be drained out by way of the costal and probably mediastinal pleurae. The effect of the greater omentum is doubtful, because no lymphatic vessels including the ink appeared there.

## 2. Hole Structure of the Mediastinum

India ink was present in both pleural cavities, notwithstanding it was injected into only the right cavity without injury of the mediastinum.

A stretch preparation of the mediastinum, stained with hematoxylin, sudan III, VAN GIESON's stain or GÖMÖRI's silver oxide solution was observed; the mediastinum is pierced by innumerable holes whose boundaries are supported by fine lace-like nets consisting of collagenous bundles covered by mesothelial cells (Figs. 1 and 2). Their occurrence is comparatively more numerous in the caudal and ventral areas of the mediastinum, also in the fold of *Vena cava*. Such a structure is similar to that of the omentum.

## 3. Microscopical Observations of Portions Absorbing India Ink

Attempts were made to ascertain some microscopical structures of portions absorbing the ink as described by KIHARA and other workers.

The diaphragmatic peritoneum absorbing the ink was immersed in 1% silver nitrate for 30 to 60 minutes and hardened in 10% formol; the irregular boundaries of the mesothelial cells were stained dark brown by the silver nitrate. Black spots of the ink appeared between the edges of the mesothelial cells. In such areas, the cells were smaller in size than those in other areas where the black spots are not present (Fig. 3). The spots agree with CHUNG's "stomata".

Another diaphragmatic peritoneum was stained with GÖMÖRI's silver impregnation; under the mesothelium of the area absorbing the ink, there was a mesh structure consisting of collagenous and argyrophilic fibers. Particles of the ink were present restrictedly in the mesh (Fig. 4). This structure agrees with TSUBOUCHI's "*Macula cribriformis*".

## 4. Lymph Nodes and Routes Participating in Lymphatic Drainage from the Peritoneal Cavity

After injecting India ink into the peritoneal cavity, the ink was absorbed into the lymph nodes, as represented in table 2.

In the thoracic cavity:—*Lnn. sternales*: all cases (100%); *Ln. mediastinalis ventralis*, found in only 3 cases: all cases (100%); *Ln. diaphragmaticus*, found in only 3 cases: all cases (100%); *Lnn. mediastinales craniales*: 9 cases among 14 (64.3%); *Lnn. tracheobronchiales caudales*: 3 cases among 14 (21.4%); *Lnn. tracheobronchiales craniales sinistri*: 1 case among 14 cases (7.1%).

TABLE 2. *Lymph Nodes which Absorbed the Ink*  
(Cases Injected into the Peritoneal Cavity)

GROUPS OF LYMPH NODES	EXP. NO.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Lnn. sternales</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ln. mediastinalis vent.</i>	.	.	.	.	+	.	.	.	+	+	.	.	.	.
<i>Ln. diaphragmaticus</i>	.	.	.	+	.	+	+	.	.	.	.	.	.	.
<i>Lnn. mediastinales cran.</i>	-	-	+	+	+	+	-	+	+	+	-	+	-	+
<i>Lnn. tracheobronchiales caud.</i>	-	-	+	-	+	-	-	-	-	-	-	-	+	-
<i>Lnn. tracheobronchiales cran. sinist.</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>Lnn. hepatogastrici</i>	-	-	+	-	-	-	-	-	+	+	+	-	-	+
<i>Lnn. gastrolienales</i>	-	-	-	-	-	-	-	-	+	+	-	-	-	-
<i>Lnn. lumbales cran.</i>	-	-	+	+	+	+	+	+	+	+	+	-	+	+
<i>Ductus thoracicus</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-

In the abdominal cavity: -*Lnn. lumbales craniales*: 11 cases among 14 (78.6%); *Lnn. hepatogastrici*: 5 cases among 14 (35.7%); *Lnn. gastrolienales*: 2 among 14 cases (14.3%).

Six routes were active in the drainage of India ink absorbed into the diaphragm from the peritoneal cavity, as follows: (see Plate II).

A. The first is the sternal route; this begins at the confluence of fine vessels of the *Pars sternalis*, *Pars costalis* and the ventral portion of the central tendon, and makes two or three trunks, anastomosing each other and running ventrad on the muscular portion. Then, the trunks run along *V. thoracica interna* and extend to *Lnn. sternales*. In one case (No. 8), some branches passed through *Ln. diaphragmaticus* on the course. In three cases (Nos. 5, 9 and 10), a collateral pathway, which must belong to this route, runs along the pericardial and diaphragmatic ramus of *V. thoracica interna*. The course passes through *Ln. mediastinalis ventralis* in the cases and then enters into *Lnn. sternales*. Efferent vessels of *Lnn. sternales* extend to the venous angles, but some vessels pass through *Lnn. mediastinales craniales* on the course.

B. The lumbar route is the second essential one; two or more lymphatic vessels, originating usually from the dorsal portion of the *Pars costalis* and in some cases (Nos. 9, 10 and 14), from the lateral portion of the *Pars lumbalis*, pierce through the diaphragm near the membranous portion and then enter into *Lnn. lumbales craniales*. The efferent vessels extend to *Cisterna chyli* and then flow away into the venous angles via the thoracic duct.

C. The third of these, the peritoneal route, begins with fine lymphatic vessels arising from the medial portion of the *Pars lumbalis*. The fine vessels are confluent to one or two large ones piercing through the diaphragm near the dorsal portion of the esophagus. The large vessels enter into *Lnn. hepatogastrici* and *Lnn. gastrolienales*. This finding

appears more conspicuously at the right side of the *Pars lumbalis*. In some cases (Nos. 9, 10, 11 and 14), one vessel, originating from the area near the termination of the left diaphragmatic nerve, runs on the central tendon and unites with the above route in the right side of the esophagus. The efferent vessels of the *Lnn. hepatogastrici* and *Lnn. gastrolinales* are confluent to the intestinal trunk and then flow into *Cisterna chyli*.

D. The pulmonary route was found in 3 cases (Nos. 3, 5 and 13); one vessel, arising from the area near the termination of the right diaphragmatic nerve, runs craniad along *Vena cava caudalis* and then enters into *Lnn. tracheobronchiales craniales sinistri* and *caudales*. The efferent vessels extend into the venous angles after passing through *Lnn. mediastinales craniales*.

E. The mediastinal route was found in 4 cases (Nos. 6, 10, in left side and Nos. 4, 14 in right side); one vessel, originating from the *Pars costalis* near the diaphragmatic nerve, runs craniad along the nerve and enters into *Lnn. mediastinales craniales* and *Lnn. sternales*. The later course is the same as sternal route.

F. The last route, suggested as a variant of the lumbar route, communicates directly with the thoracic duct; one vessel arising from the right *Pars lumbalis* empties into the thoracic duct without passing through any nodes near the crus.

### 5. Lymph Nodes and Routes Participating in Lymphatic Drainage from the Pleural Cavity

Following injection into the pleural cavity, the ink was absorbed into the lymph nodes, as indicated in table 3.

TABLE 3. *Lymph Nodes which Absorbed the Ink*  
(Cases Injected into the Pleural Cavity)

GROUPS OF LYMPH NODE	EXP. NO.															
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Lnn. sternales</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Lnn. mediastinales cran.</i>	-	-	+	-	+	-	+	+	+	+	+	+	+	-	-	+
<i>Lnn. paratracheales</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+
<i>Lnn. mediastinales dors.</i>	-	-	+	-	+	-	-	+	.	+	.	.	+	-	-	+
<i>Lnn. lumbales cran.</i>	-	-	+	-	+	-	-	+	+	+	+	-	+	+	-	+
<i>Lnn. axillares caud.</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Lnn. axillares cran.</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Ductus thoracicus</i>	-	-	+	+	+	-	+	-	+	+	+	+	+	+	-	+

In the thoracic cavity : - *Lnn. sternales* : all cases (100%); *Lnn. mediastinales craniales* : 10 among 16 cases (62.5%); *Lnn. paratracheales* : 2 among 16 cases (12.5%); *Lnn. mediastinales dorsales* : 6 among 13 cases (46.1%).

In the abdominal cavity:—*Lnn. lumbales craniales*: 9 among 16 cases (56.3%).

In the superficial area:—*Lnn. axillares craniales* and *caudales*: 1 among 16 cases (6.3%).

The lymphatic drainage from the pleural cavity also proceeds by six routes, as follows:— (see Plate III).

A. The first is the sternal route, by far the most important, which originates from the caudo-ventral portion of the costal pleura. The route begins with fine vessels along *A.* and *V. intercostalis* and then the fine vessels unite into large vessels along *A.* and *V. thoracica interna*. The later course agrees with the sternal route originating from the peritoneal cavity.

B. The lumbar route begins usually from one or two fine vessels arising in the dorsal portion of the caudal 4 intercostal spaces. From here, the vessels run dorsad along *A.* and *V. intercostalis* and then caudad along the lateral edge of *M. quadratus lumborum*. After piercing into the diaphragm, the vessels unite with the lumbar route from the peritoneal cavity.

C. The costal route appears inconstantly; it begins from the dorsal portion of the median intercostal spaces, usually the fifth to tenth intercostal ones. The route runs dorsad along *A.* and *V. intercostalis*, and then enters into *Lnn. mediastinales dorsales*. The efferent vessels extend into the thoracic duct.

D. The tracheal route, found in the right side only, is a variant of the costal route; it runs along *V. azygos* and enters into *Lnn. paratracheales dextri*. The efferent vessels extend into *Lnn. mediastinales craniales*.

E. The fifth is the axillar route, which was found in both sides of one cases; a lymphatic vessel, arising from the ninth intercostal space, pierces the thoracic wall and then comes out running along *V. thoracica lateralis* in the subcutis. The flow passes through *Lnn. axillares caudales* and *craniales*. The efferent vessels of the latter form the subclavicular trunk and enter into the venous angles.

F. The last is other variant of the costal route; the flow enters into the thoracic duct without passing through *Lnn. intercostalis*, *Lnn. mediastinales dorsales* or other nodes.

There are some doubts whether the drainage by way of the mediastinum is of use or not. If so, the sternal route may be most probable for carrying the drainage, because a fine vessel including the ink was found along the pericardial and diaphragmatic ramus of *V. thoracica interna* and entering into *Lnn. sternales* in two cases (Nos. 19 and 23). The course does not originate from the costal pleura at least.

*Lnn. mediastinales craniales* may not be primarily related with the drainage of the pleural cavity, but secondarily receive the efferent vessels from *Lnn. sternales*.

#### DISCUSSION

The lymphatic drainage from the peritoneal and pleural cavities was investigated in 30 cats.

India ink injected into the right pleural cavity was also found in the left cavity. This finding has been already described by TSUBOUCHI and COURTICE & SIMMONDS without any discussion.

AGDUHR stated that slight communication of pleural fluid between the two pleural cavities is possible by rents of the mediastinum which are found dorsad from the esophagus in some species of animals.

By careful microscopical observation, the present writers demonstrated innumerable holes piercing into the mediastinum, especially in the ventral and caudal portions from the pericardial sac. The localization of the holes disagrees with AGDUHR's description. The like is found in the omentum, as described by MAXIMOW and BLOOM.

According to the obtained finding, the pleural fluid is able to pass freely between the two pleural cavities.

Injected ink was adherent to the diaphragm and greater omentum in the peritoneal cavity, also to the costal pleura and mediastinum in the pleural cavity.

According to the lymph nodes and vessels absorbing the ink, the lymphatic drainage from the peritoneal cavity begins from the diaphragm, most effective in the *Pars sternalis* and *costalis*. Drainage of the pleural cavity starts chiefly from the costal pleura, especially in the caudo-ventral area, and probably from the mediastinum.

It is open to doubt whether the ink was drained via the lymphatic vessels of the omentum from the peritoneal cavity. POYNTER, SHIPLEY and CUNNINGHAM concluded that foreign particles in the peritoneal cavity are drained via the portal vein of the omentum, but not via the lymphatic vessels. Therefore, it seems that only the diaphragmatic peritoneum is of use in the lymphatic drainage from the peritoneal cavity.

OKAZAKI stated that the mediastinum is related with the lymphatic drainage from the pleural cavity. The present writers also found some evidences that the mediastinum may be related with the drainage, but the area may be less effective than the costal pleura.

According to the way of the transportation of particular materials from the mesothelium to the lymphatic vessels, there are three theories with some variance of opinion; via the stomata or stigmata (v. RECKLINGHAUSEN), between the mesothelial cells (MACCALLUM) and in the cells but not between the cells (CUNNINGHAM).

In 1937, CHUNG demonstrated that stomata exist between the mesothelial cells of the diaphragmatic peritoneum. The localization of CHUNG's stomata differs from v. RECKLINGHAUSEN's description. Recently MAGARI demonstrated the stomata by means of electronmicroscopic observation.

WATANABE found that the mesothelial cells in the area where stomata exist restrictedly are smaller in size than these in the other areas in the diaphragm of the rabbit.

KIHARA, TSUBOUCHI and others, by histological studies, have made items of the other specific structure of absorbing areas clear. The structure consists of fine meshes of collagenous and argyrophilic fibers between lymphatic capillary and mesothelium, called "*Macula cribriformis*" or "*Membrana cribriformis*" in accordance to its extension. The structure is a pattern of "Prälymphovasculäre Saftbahn" of "Extravasculäres Saftbahnsystem" according to KIHARA.

The writers' finding agrees with the work of CHUNG, KIHARA, WATANABE, TSUBOUCHI and others.

That is, it seems that India ink injected into the peritoneal and pleural cavities passes through CHUNG's "stomata" and TSUBOUCHI's "*Macula* and *Membrana cribriformis*". Then the ink is absorbed into the lymphatic vessels.

In respect to the lymphatic courses transporting particular matters from the mesothelial cavities, OGO (from the peritoneal cavity in the rabbit), TESHIMA (from the peritoneal cavity in the rabbit) and HIGGINS & GRAHAM (from the peritoneal cavity of the dog) have reported in detail. But, there are no detailed descriptions in the cat; brief descriptions were attempted with clinical or physiological objects but not with anatomical ones by BOLTON, BROWN, SHIDA, COURTICE & SIMMONDS and others.

BOLTON and BROWN pointed out that the lymph nodes related with the lymphatic drainage from the peritoneal cavity are *Lnn. sternales*, *Lnn. mediastinales* and *Lnn. lumbales craniales* in the cat. But, no description was published of the courses.

The present writers newly found that *Lnn. hepatogastrici*, *Lnn. gastrolienales*, *Ln. diaphragmaticus* and *Ln. mediastinalis ventralis* are related with the drainage. The courses were distinguished into six routes; if their orders can be judged by the obtained finding, they may be as follows. 1. sternal route, 2. lumbar route, 3. probably peritoneal route, 4. pulmonary or mediastinal routes and the last route extending to the thoracic duct without passing through any nodes.

The above routes are similar to HIGGINS' description in the peritoneal cavity of the dog, but the occurrences of each route differ more or less from the writers' finding in the cat.

TESHIMA and OGO demonstrated constantly a route extending directly to the thoracic duct and the costal route regarding the peritoneal lymphatic drainage in the rabbit. But, such routes were not found in the cat.

According to the lymphatic drainages from the pleural cavity in the cat, SHIDA and COURTICE & SIMMONDS pointed out three nodes, *Lnn. sternales*, *Lnn. mediastinales craniales* and also *Lnn. intercostales*, probably corresponding with the writers' *Lnn. mediastinales dorsales*, but did not describe the courses in detail.

The present writers supplemented four nodes, *Lnn. lumbales craniales*, *Lnn. paratracheales*, *Lnn. axillares craniales* and *caudales*. The routes are divided into six; sternal, lumbar, costal, tracheal, axillar and a variant of the costal route entering directly into the thoracic duct without passing through any nodes. Their order may be as follows according to the obtained findings; 1. sternal route, 2. lumbar route, 3. probably costal route and route entering directly into the thoracic duct, 4. tracheal route and the last axillar route.

The degrees of effectiveness of the lymph nodes related with lymphatic drainage from the peritoneal and pleural cavities are indicated in table 4.

TABLE 4. *Lymph Nodes Related First with Lymphatic Drainages from Both Cavities*

GROUP OF LYMPH NODES	CAVITY INJECTED INK		
	Peritoneal	Pleural	
Thoracic cavity	<i>Lnn. sternales</i>	###	###
	<i>Lnn. mediastinales cran.</i>	+	-
	<i>Ln. mediastinalis vent.</i>	+	-
	<i>Lnn. mediastinales dors.</i>	-	++
	<i>Ln. diaphragmaticus</i>	+	-
	<i>Lnn. paratracheales</i>	-	+
	<i>Lnn. tracheobronchiales caud.</i>	+	-
	<i>Lnn. tracheobronchiales cran. sinist.</i>	+	-
Abdominal cavity	<i>Lnn. lumbales cran.</i>	##	##
	<i>Lnn. hepatogastrici</i>	+	-
	<i>Lnn. gastrolienales</i>	+	-
Body surface	<i>Lnn. axillares caud.</i>	-	+
	<i>Lnn. axillares cran.</i>	-	-
<i>Ductus thoracicus</i>	+	++	

Remarks: - : Not effective      ## : Strong effective  
 + : Slight effective      ### : Strongest effective  
 ++ : Moderate effective

As suggested in the table, the most effective node is *Lnn. sternales* related with the sternal route in the drainage from both the peritoneal and the pleural cavities. *Lnn. lumbales craniales* and the lumbar route are secondarily effective. On the other hand, the others appear inconstantly and are slightly effective.

The route entering directly into the thoracic duct without passing through

any nodes was found as a variant of the costal route in the thoracic cavity and one of lumbar route in the peritoneal cavity, originating from the costal pleura and diaphragmatic peritoneum respectively. They are important routes as direct pathways from the mesothelial cavity to the blood vessel without any barricades of nodes in the pathological and physiological views.

#### SUMMARY

In 30 cats, the lymphatic drainages from the peritoneal and pleural cavities were observed.

The findings may be summarized as follows:

1. India ink injected into the peritoneal cavity is absorbed from the diaphragmatic peritoneum. The ink probably passes through CHUNG's "stomata" and TSUBOUCHI's "*Macula cribriformis*", and then is absorbed into the lymphatic vessels in the diaphragm. From here, the ink flows away to the venous angles via six routes; sternal, lumbar, peritoneal, pulmonary, mediastinal and a last route communicating directly with the thoracic duct.

2. From the pleural cavity, the ink injected is absorbed into the lymphatic vessels in the ventral and caudal portions of the costal pleura and probably in the mediastinum. The routes were distinguished into six routes; sternal, lumbar, costal, tracheal, axillar and a variant of the costal route entering into the thoracic duct without passing through any nodes.

3. The lymph nodes related primarily with the lymphatic drainage from the peritoneal cavity are *Lnn. sternales*, *Ln. mediastinalis ventralis*, *Ln. diaphragmaticus*, *Lnn. mediastinales craniales*, *Lnn. tracheobronchiales caudales*, *Lnn. tracheobronchiales craniales sinistri*, *Lnn. hepatogastrici*, *Lnn. gastrolienales* and *Lnn. lumbales craniales*. These from the pleural cavity are *Lnn. sternales*, *Lnn. paratracheales*, *Lnn. mediastinales dorsales*, *Lnn. axillares caudales* and *Lnn. lumbales craniales*. *Lnn. mediastinales craniales* are rather effective as nodes related secondarily with the drainage.

4. If their relative rank can be judged, the most effective route may be the sternal route and *Lnn. sternales*. The second are probably the lumbar route and *Lnn. lumbales craniales*. This tendency may be the same in both cavities. Other routes and nodes are less effective.

5. In this observation, the hole structure is described of the mediastinum permitting of communication between the right and left pleural cavities. The occurrences are more numerous in the caudal and ventral areas of the mediastinum and also in the fold of *Vena cava*. Such structure is similar to that of the greater omentum.

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## EXPLANATION OF PLATES

## PLATE I

- Fig. 1. A stretch preparation of the mediastinum stained with hematoxylin and sudan III. Showing innumerable holes.  $\times 100$ .
- Fig. 2. Showing bundles of collagenous fibers of the hole frame. GÖMÖRI's silver impregnation.  $\times 400$ .
- Fig. 3. Showing intercellular boundaries of the mesothelial cells in the diaphragmatic peritoneum. Black spots of the ink injected are present between the edges of smaller cells (arrows). 1% silver nitrate stain.  $\times 400$ .
- Fig. 4. TSUBOUCHI's so-called "*Macula cribriformis*". The ink confined to the mesh. GÖMÖRI's silver impregnation.  $\times 400$ .

## PLATE II

- Fig. 5. Showing six routes of lymphatic drainage from the peritoneal cavity. Pleural surface of the diaphragm.
1. sternal route, 2. lumbar route, 3. peritoneal route, 4. pulmonary route,
  5. mediastinal route, 6. route extending directly into the thoracic duct.

## PLATE III

- Figs. 6 & 7. Showing six routes of lymphatic drainage from the pleural cavity.
1. sternal route, 2. lumbar route, 3. costal route, 4. tracheal route,
  5. axillar route, 6. route extending directly into the thoracic duct.

FIG. 1.

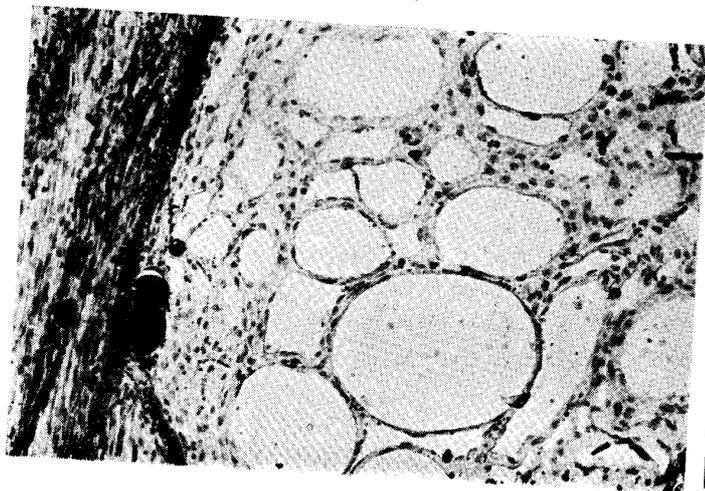


FIG. 2.



FIG. 3.

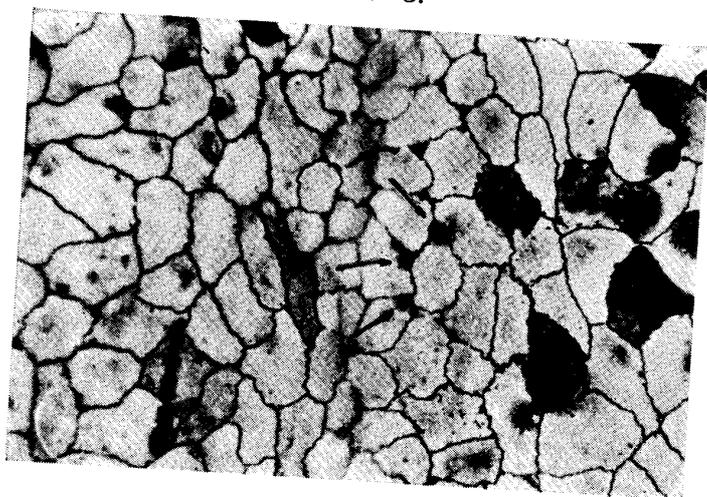


FIG. 4.

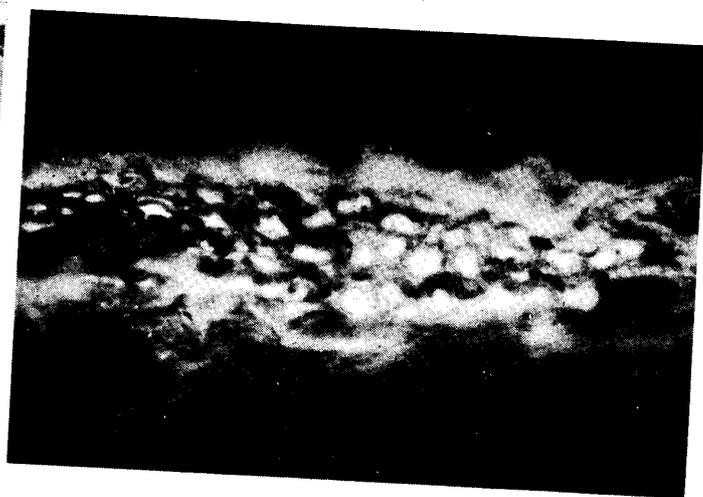


FIG. 5.

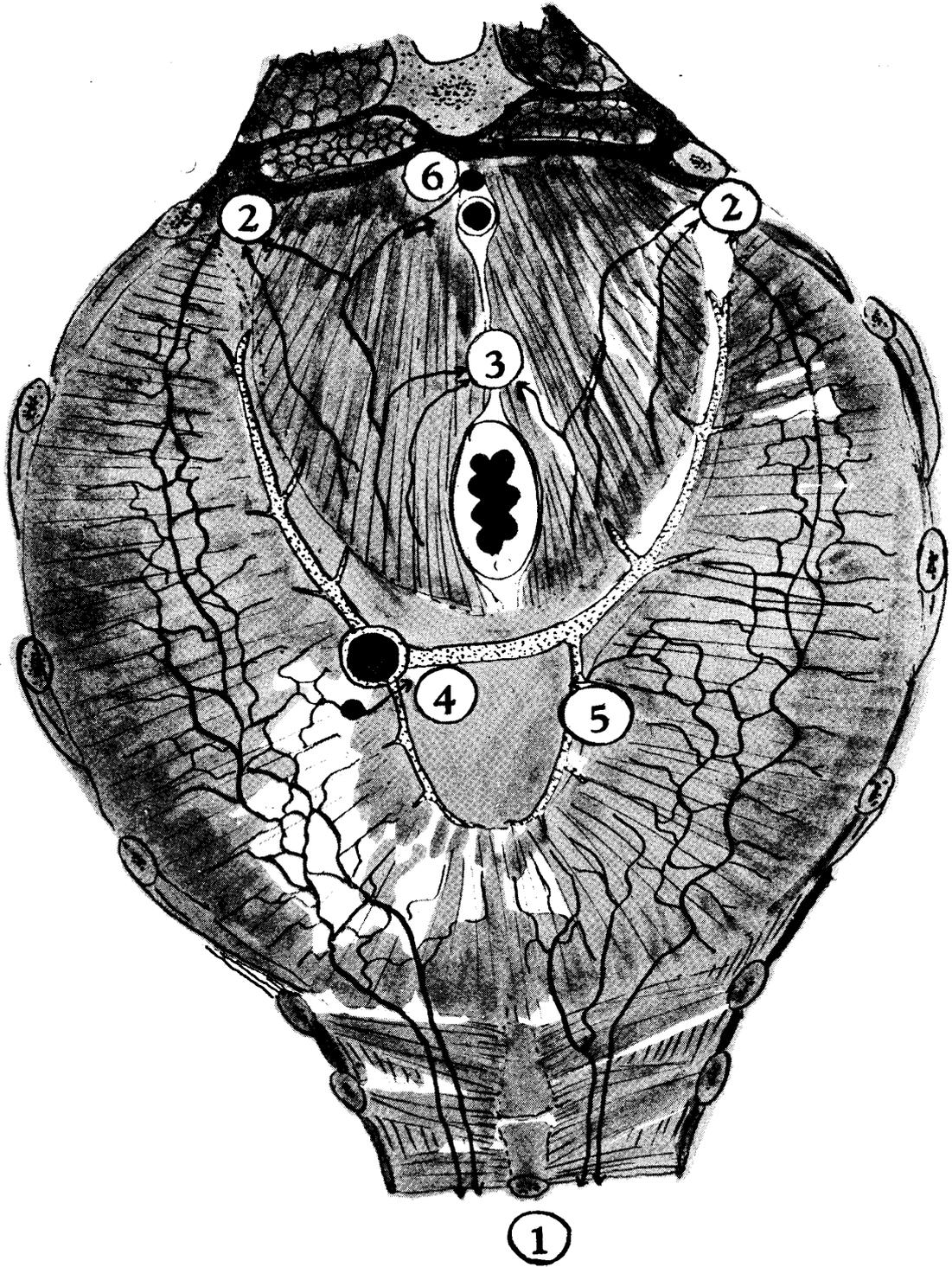


FIG. 6.

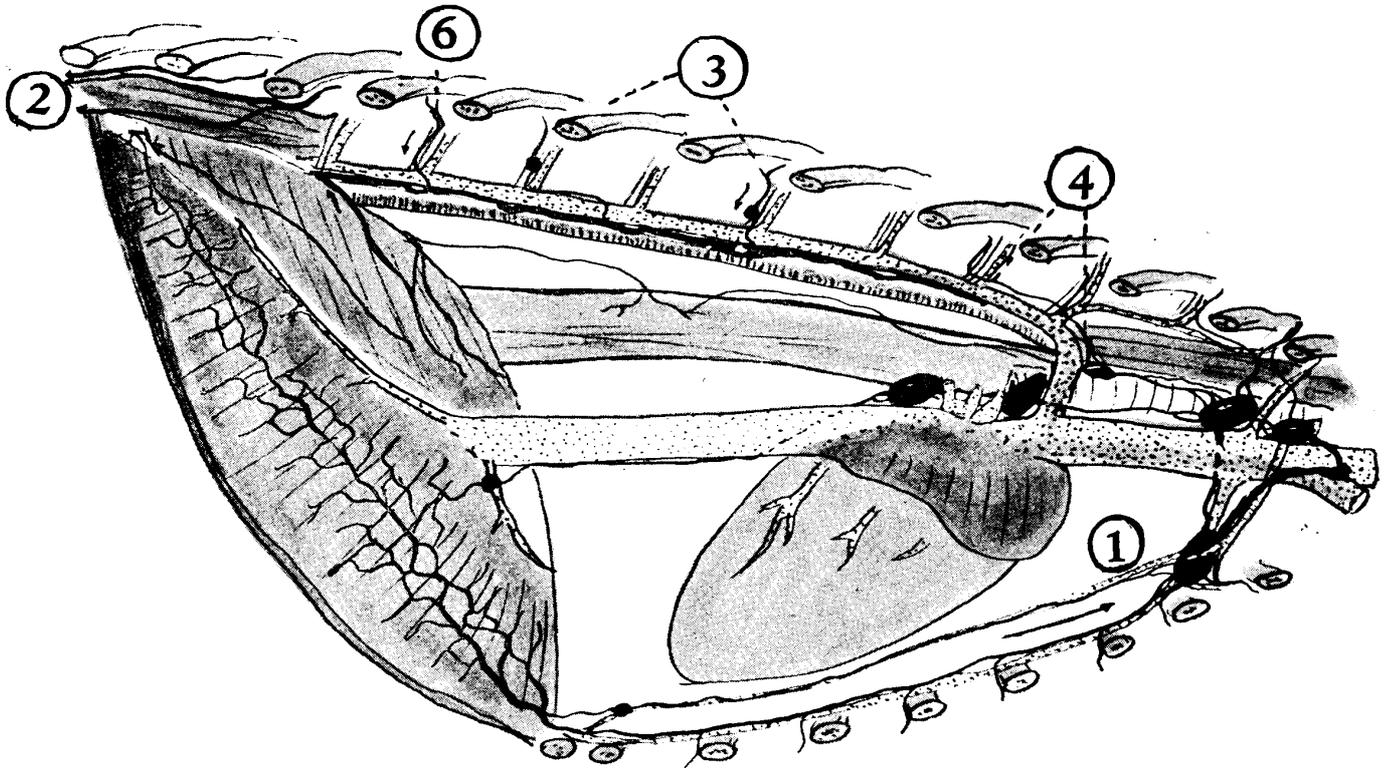


FIG. 7.

