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## DISTRIBUTION OF LYMPHATIC TISSUES IN DUCK CAECA\*<sup>1</sup>

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The distributions of the subepithelial lymphatic tissues were examined in the duck caeca. The lymphatic tissues were distributed more densely in the proximal one-tenth part of the body of the organs. The diffuse lymphatic tissues were located in the propria, while the nodular ones with germinal centers were found in the submucosa.

### INTRODUCTION

It is well known that there is a well-developed subepithelial lymphatic tissue in the proximal part of the avian caecum, as described by BASSLINGER (1858). The lymphatic tissues are called "caecal tonsilla". The present writers have discovered that there are no structures corresponding to the caecal tonsilla in the proximal part of the duck caeca—unlike the chicken—in immunobiological studies on the duck lymphatic tissues.

In the present paper, the distributions of the lymphatic tissues in the whole length of the duck caeca are described for obtaining the basic data in the immunobiological studies of the organs in the duck.

### MATERIALS AND METHODS

Caeca of 21 White Pekin ducks, 1 week to 3.5 years old, were used as materials. Out of them, the caeca of 16 ducks were fixed in 10% formalin, embedded in paraffin, and then sectioned 5 to 10  $\mu$  in thickness. They were stained with hematoxylin-eosin, Masson's trichrome, and Gomori's silver impregnation for reticular fibers. For the scanning electron microscopical observation, the caeca of 5 ducks were fixed in 2.5% glutaraldehyde and 1% osmic acid,

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dehydrated with graded ethanol followed by isoamyl acetate, and then dried in a critical point drying apparatus (HCP-1). The dried specimens were coated with carbon and gold in a vacuum evaporator and observed under a JSM-S 1 scanning electron microscope (SEM) using a beam accelerating voltage of 10 kv.

Out of the caeca used in this histological observation, 18 caeca of 9 ducks were longitudinally cut open and then rolled. The rolled caecum was fixed in 10% formalin, embedded in paraffin, and then sectioned along the course of the caecum (fig. 4). The sections stained with hematoxylin-eosin or Masson's trichrome were projected about 13 times on a screen and traced on a paper for examining the distributions of the lymphatic tissues. The caecal tonsillae of four chickens, 5 weeks to 3 months old, were also examined histologically.

## RESULTS

In an adult duck the caecum was about 15 to 17 cm in length and clearly divisible into two parts; the narrowed neck extended from the ileo-caecal junction to one-fourth of the distance along the caecum and the following body extended to the blind end sac. No ampullaceous part was found in the proximal part of the duck caecum, unlike the chicken caecum in which the caecal tonsilla was observed at a corresponding site.

In observations on the mucosal surface, the point of change between the neck and the body was clearly distinguished; the neck with numerous villi was characterized from the body in which no villi could be found (figs. 1 & 2). There were several longitudinal ridges on the mucosal surface of the body and blind end sac. White spots, 3 to 4 mm in size, were observed more densely in the proximal part of the body and in the end part of the blind sac. Under the SEM the white spot was a gently convexed dome with a smooth surface surrounding irregular secondary folds (fig. 3). The histology of the white spots showed that they were subepithelial lymphatic tissues including germinal centers.

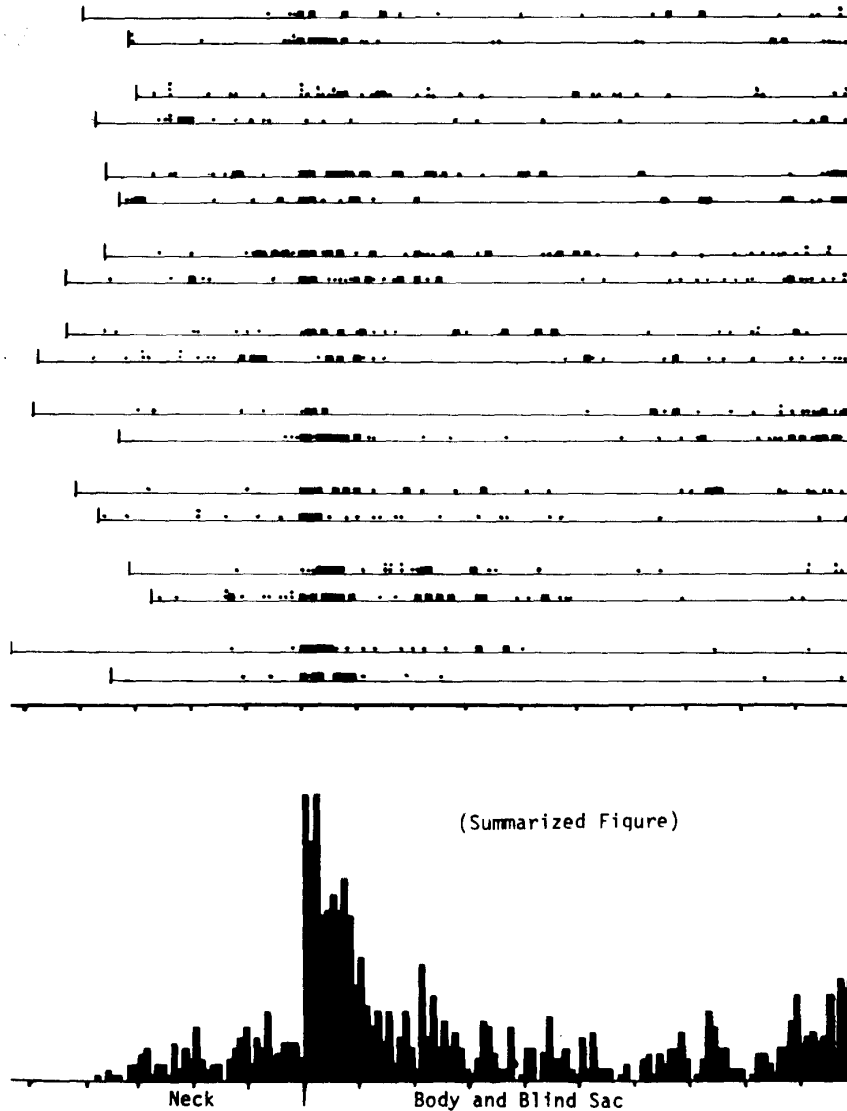
The distributions of the lymphatic tissues in both caeca of 9 ducks were histologically examined as shown in the text-figure. In the figure, the total length of the body to blind end sac was indicated at 100%, and a base point was made at a boundary between the neck and the body because of clarification of the boundary in all cases. As shown in the text-figure, the lymphatic tissues were observed more frequently in the proximal one-tenth part of the body and frequently in the end part of the blind sac.

The lymphatic tissues consisted of two parts: the diffuse lymphatic tissues in the propria and the lymphatic nodules, including germinal centers, in the submucosa (figs. 4 & 5). The two parts were connected by a narrow diffuse lymphatic tissue through the muscularis mucosa. The lymphatic nodules were

often deeply embedded in the muscular layer (fig. 6).

The caecal tonsilla of the chicken could be found as a well-developed diffuse lymphatic tissue restricted in the propria, and the germinal centers were often found in the diffuse lymphatic tissue, but not in the submucosa.

TEXT-FIGURE *Distribution of lymphatic tissues in duck caeca*



Each line with points and squares shows the total length of a caecum.

● : One to three lymphatic nodules

■ : Four and more nodules

In summarized figure, a point and a square in the one above is emphasized as a square and four squares respectively.

## DISCUSSION

The present experiment shows that the lymphatic tissues of the duck caecum are distributed more densely in the proximal one-tenth part of the body. This finding differs from cases in the chicken, in which a well-developed lymphatic tissue, "the caecal tonsilla", is always located near the ileo-caecal junction in the caecum (CALHOUN, '32/'33; PAYNE, '71). The results show that a sample from the proximal one-tenth part of the caecal body is more efficient for examining the caecal lymphatic tissues in the duck. The beginning part of the body is without villi clearly distinguished from the neck with numerous villi, as pointed in the turkey caecum (WILKINS & LEE, '74).

Histologically, the diffuse lymphatic tissues with germinal centers occupy only the propria in the chicken caecum (CALHOUN, '32/'33; HOFFMANN-FEZER, '73), whereas in the duck caecum the diffuse lymphatic tissues and the lymphatic nodules with germinal centers are separately located in the propria and in the submucosa respectively. The lymphatic nodules were often deeply embedded in the muscular layer, as described by JACOBSHAGEN ('38). Therefore, the lymphatic tissues in the duck caecum may show different changes from those of the chicken caecum in immune response. Further studies should be done concerning the structural and functional differences between both species of birds.

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## EXPLANATION OF FIGURES

### PLATE I

- Fig. 1 A stretched duck caecum  
The neck with numerous villi is clearly distinguished from the body without villi (a dotted line). The subepithelial lymphatic tissues are observed as white spots on the mucosal surface.  $\times 2.4$
- Fig. 2 Note numerous villi in the neck under the SEM.  $\times 30$
- Fig. 3 The mucosal surface of the body under the SEM  
A white spot is observed as a smooth convexed dome (arrow). Note irregular secondary folds on the longitudinal ridges.  $\times 30$

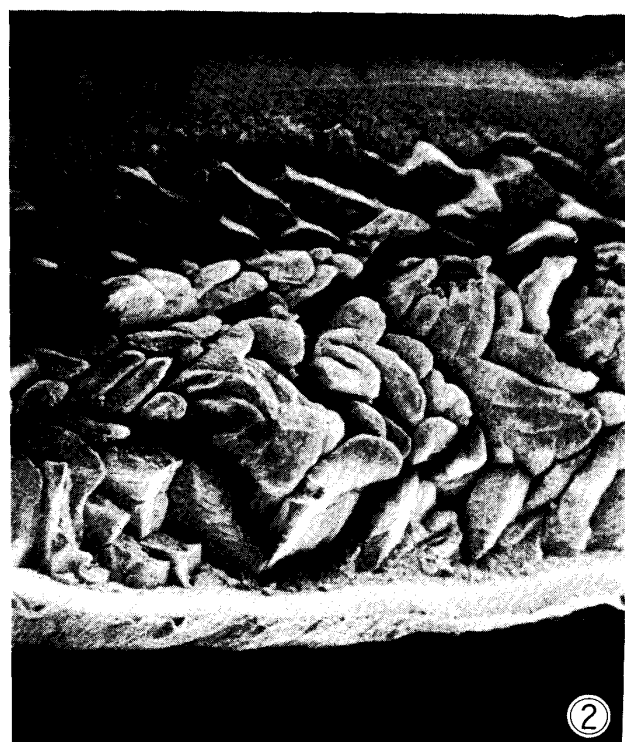
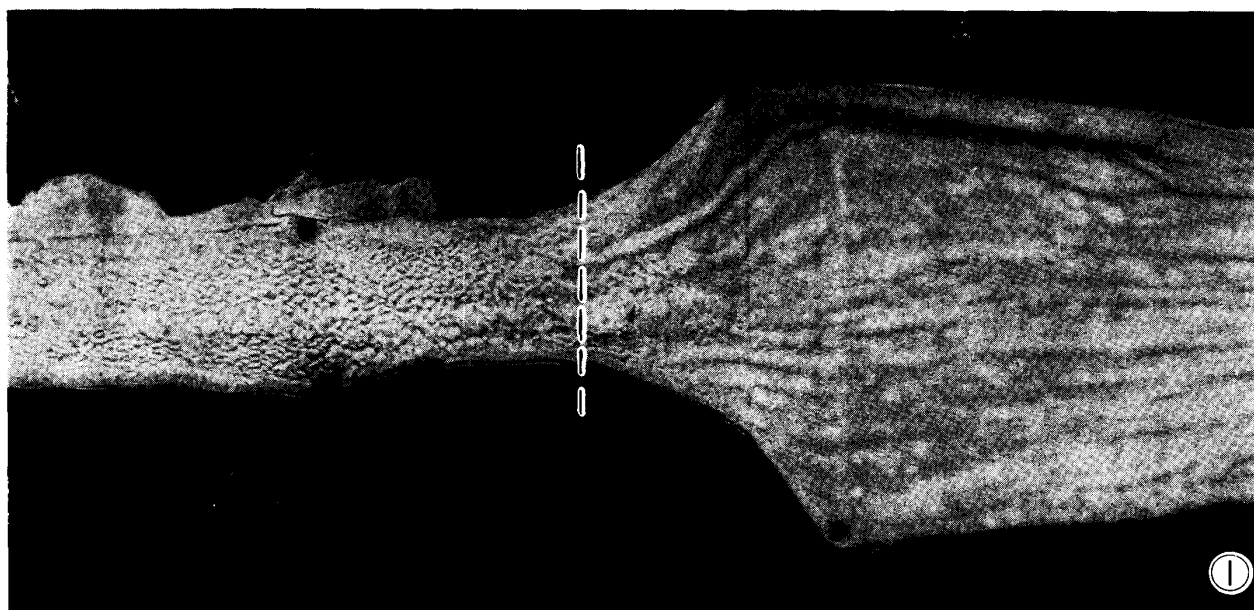
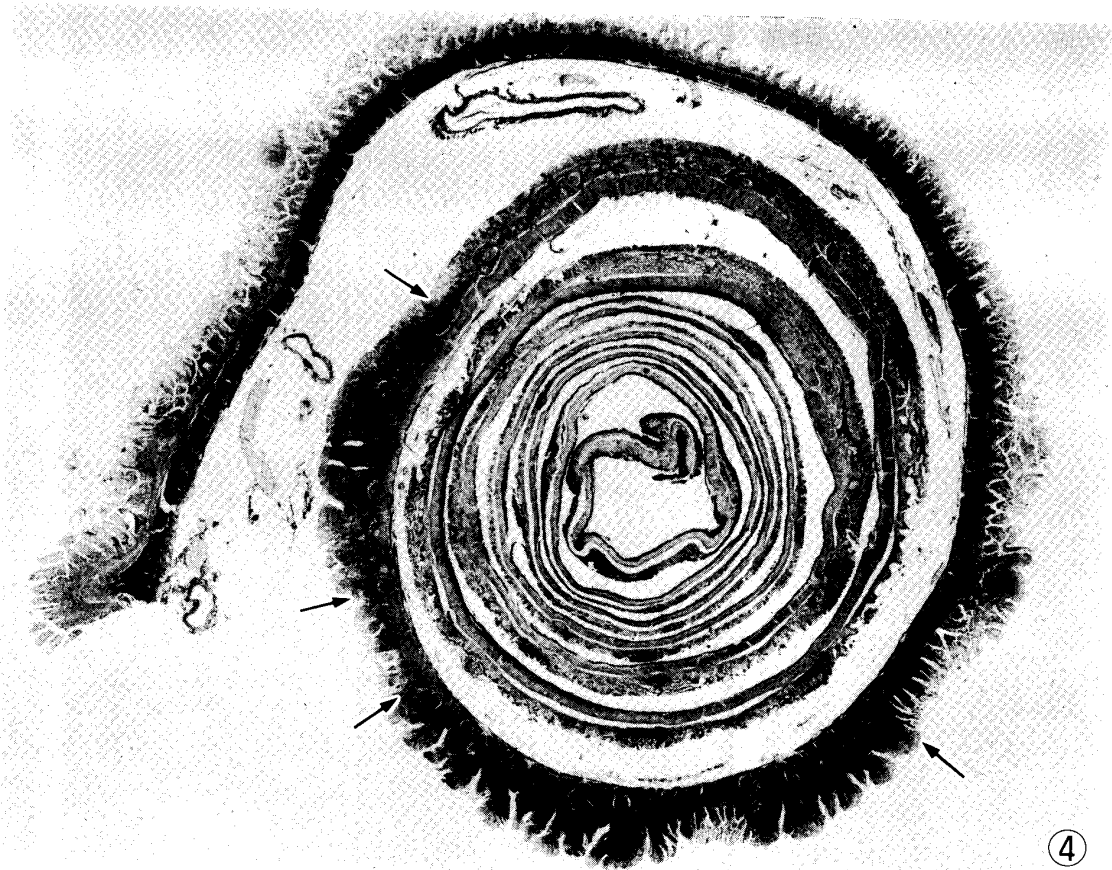


PLATE II

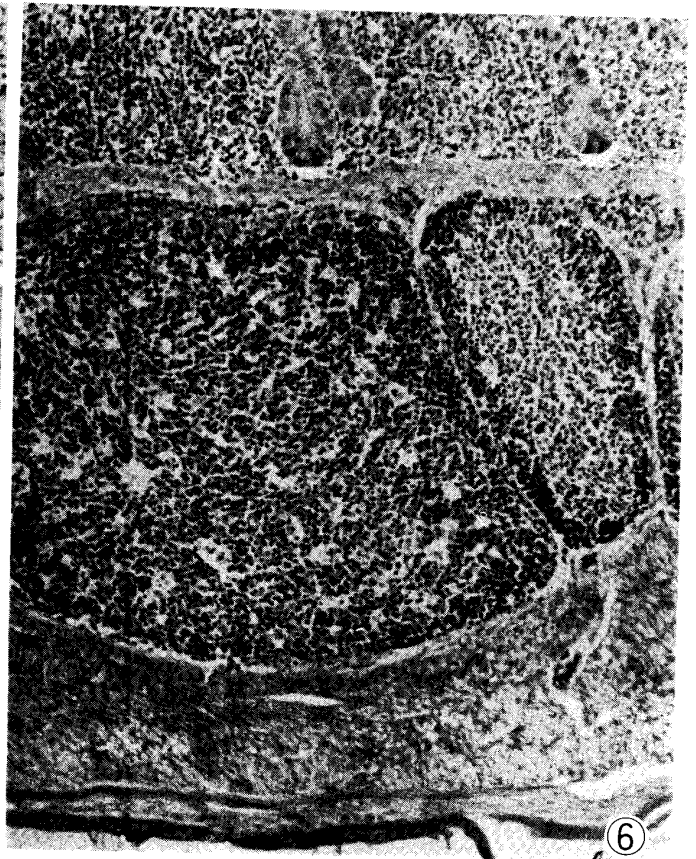
- Fig. 4 A section of the whole length of the caecum  
Well-developed lymphatic tissues are observed in the end part  
of the neck and the proximal part of the body in this case  
(arrows). Masson's trichrome  $\times 5.4$
- Fig. 5 The lymphatic tissue consists of the diffuse lymphatic tissues  
in the propria and the large lymphatic nodule in the submucosa.  
H-E,  $\times 55$
- Fig. 6 Two lymphatic nodules with germinal centers are embedded in  
the muscular layer. H-E,  $\times 140$



④



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