

HISTOLOGY OF THE MAMMARY GLAND IV. COMPARATIVE MORPHOLOGY OF THE DEGENERATIVE LYMPHOID CELLS IN THE MAMMARY TISSUES, LYMPHOID ORGANS AND GUT OF MICE

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LYMPHOID CELLS IN THE MAMMARY TISSUES,
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By

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Introduction

Cytological and histological studies of the colostrum bodies have been made by many investigators. Berka (2), Czerny (3), Gruber (7), Weatherford and Emmel(15), Eemmel *et al.*(6), Jeffers(8) and Okada(10) found that, during the farrowing and weaning period, the lymphoid cells penetrated into the mammary alveoli, where the cytoplasm of the cells hypertrophied and their nuclei underwent pycnotic subdivision, and finally the colostrum bodies were formed. Thus, it is clear that the colostrum bodies are nothing but a picture of the degeneration of the lymphoid cells within the mammary alveoli or secreted milk.

It is known that the degeneration of the lymphoid cells occurs in many lymphatic tissues(9). Further, there are investigations concerning the degeneration or destruction of the lymphoid cells in the lymphatic tissues with special reference to the antibody formation and hormones (4, 5, 12). However, there are no comparative morphological investigation about the degenerating lymphoid cells in various kinds of organs such as the mammary tissues, thymus, spleen, ileum and duodenum. Therefore, this investigation deals with, using the mice, the comparative cytology and cytochemistry of the degenerative lymphoid cells which occurred in these organs as well as the degenerative lymphoid cell counts at the farrowing and weaning stages of the animals.

Materials and Methods

In this investigation, 19 female mice of Swiss strain, five to six months old, were used. Each animal was kept under the same feeding and management conditions. The youngs were weaned at the 24th or 26th day of post-partum. The animals at the resting, immediate post-partum, 9th, 26th and 28th days of

post-partum were sacrificed and pieces of the mammary gland, duodenum, ileum, spleen and thymus were obtained.

The materials were fixed in 10 per cent neutral formalin, Zenker-formol fluid and Regaud's fluid. The materials fixed in 10 per cent neutral formalin were embedded in carbowax and sectioned at the thickness of 10μ . The materials fixed in other fixatives were embedded in paraffin and cut at the thickness of 6μ .

The staining methods were as follows: For general observation of the degenerative lymphoid cells, Maximow's stain; for polysaccharides, PAS method modified by Lillie; the identification of glycogen was made by means of the salivary test (37°C , 2 hours). For RNA, toluidine blue stain. RNA was confirmed by the ribonuclease treatment (37°C , 1 hour). For lipids, propylene glycol-sudan method; for mitochondria, Heidenhain's iron-hematoxylin stain.

Results

1. *The cytological observations of the degenerative lymphoid cells.*

Comparative cytological observations of the degenerative lymphoid cells which appeared in the mammary tissues at the immediate post-partum, mid-lactation and post-weaning and those which appeared in the thymus, spleen, ileum and duodenum at the resting, immediate post-partum and post-weaning, were made on the sections stained with Maximow's hematoxylin-Azure II-eosin.

In the degenerative lymphoid cells of the mammary gland, the regions where the lipid globules were present were observed as the large vacuolations after the treatment with alcoholic solution.

The mammary gland.

The glandular lumina: Three kinds of degenerative lymphoid cells were found in this area. They are shown in Table 1 and Figs. 1, 2 and 3. As shown in Figs. 1 and 3, the degenerative large lymphoid cells had voluminosly swollen cytoplasm, some of which reached to 20μ in size, and had many vacuolations and pycnotic nuclear fragments. These elements were originated obviously from large lymphoid cells such as large lymphocytes, monocytes and histiocytes. They showed two types of affinity to Azure II. The cells in first type were stained deep bluish purple with Azure II (Fig. 1). The ones in second type were unstained with this dye but were stained deep yellowish red with eosin. In many cases, the latter cells contained more pycnotic nuclear fragments than the former cells (Fig. 3).

The degenerative small lymphoid cells shown in Fig. 2 were smaller than those cells mentioned above. These elements had less vacuolations and a pycnotic nucleus. They contained no azurphilic granules and their swollen

cytoplasm were stained densely with eosin. They were obviously of small lymphocyte origin.

The glandular epithelia: In this area the degeneration of the lymphoid cells were found in every stage, especially at the post-weaning (Fig. 22). Three kinds of degenerative lymphoid cells were also found. The general aspects of these cells were the same as those which appeared within the mammary alveoli, except that the cytoplasm of the former atrophied in a less degree.

The intralobular connective tissue area: In this area the degenerative lymphoid cells occurred abundantly at the post-weaning, when the mammary gland begun to take a regressive change, but scantily at the immediate post-partum and mid-lactation. These degenerative lymphoid cells showed generally moderate hypertrophy of their cytoplasm and included two or three vacuolations. Some of the cells that appeared at the post-weaning had a largely swollen cytoplasm and pycnotic nuclear fragments similar to those of the so-called colostrum bodies (Fig. 20). They were found rarely in the limited area of the intralobular connective tissue.

It was noticed that the degenerative large lymphoid cells shown in Fig. 4 had azurphilic granules in their moderately swollen cytoplasm. These granules disappeared in the early stage of their degeneration. These cells belonged to the large lymphoid cells in the first type. The degenerative process of the small lymphocytes is presented in Fig. 5. Their cytoplasm did not swell and were stained with eosin so faintly that it was difficult to follow the outline of the cytoplasm. The vacuolated degenerative plasmacytes were rarely found in this area (Fig. 6). Their vacuolations were stained light red with eosin, but the matrix was unstained with eosin and stained very weakly with Azure II. In advanced degeneration the segmented nuclei of these cells showed no pycnosis, and the periphery of their cytoplasm was stained weakly with eosin. The degenerative large lymphoid cells containing no azurphilic granules are shown in Fig. 7. They were the same cells as the large lymphoid cells in the second type found in the glandular lumina. They occurred scantily in the immediate post-partum and mid-lactation, but abundantly in the post-weaning. These degenerative large lymphoid cells contained more pycnotic nuclear fragments than those containing azurphilic granules, while they had not largely swollen cytoplasm and were stained faintly with eosin.

The thymus.

The cortex: Lymphoid cells in the cortex of the thymus were composed of lymphocytes, the so-called thymocytes and reticular cells. The thymocytes were larger in size than the small lymphocytes in the mammary tissues and had a small amount of cytoplasm. The reticular cells were elongated and had

pale, round or oval nuclei which contained a few small chromatin particles and one or two nucleoli.

The degenerative thymocytes were found frequently in this area. They were noticed by the presence of nuclear debris. They are presented in Figs. 8 and 9. Since the degenerative thymocytes were closely packed with the surrounding normal thymocytes, it was difficult to follow the outline of the shrunk cytoplasm that stained weakly with eosin. Their nuclei took pyknosis and were subdivided into two or three nuclear debris.

The medulla: In this area, thymocytes were less and plasmacytes appeared frequently. Degenerative small and large thymocytes were found. They had moderately swollen cytoplasm containing two or three vacuolations. The cytoplasm was stained moderately with eosin, and contained no azurphilic granules (Figs. 10, 11 and 27). The vacuolated degenerative plasmacytes were rarely found. The vacuolations were stained faintly or weakly with eosin. When the vacuolations were numerous the cytoplasm showed a hive-like picture (Fig. 12). The matrix was stained pale purple with Azure II. The degenerative large lymphoid cells which may be classified as the degenerative reticular cells were rarely found in the medulla (Fig. 13), and in some cases they contained a few azurphilic granules in their cytoplasm. In advanced stage of the degeneration their nuclei showed high fragmentation as those of the degenerative large lymphoid cells in the second type which appeared in the mammary tissues.

The spleen.

The white pulp: The meshes of the framework in the white pulp of the spleen were filled with the lymphocytes of various size, and the degeneration of the lymphocytes was noticed by the presence of the nuclear debris. The cytological aspects of these degenerative lymphocytes were the same as those in the cortex of the thymus (Figs. 14, 15 and 28).

The red pulp: In this area, there were many lymphoid cells such as the small and large lymphocytes, free macrophages containing phagocytic inclusion and other granular leucocytes from the circulating blood.

The degenerative lymphocytes are shown in Figs. 16 and 29. The cytoplasm was scanty and the nuclei did not show ordinary pyknotic fragmentation and were stained diffusibly with hematoxylin and eosin. Weakly stained chromatin threads were found tangled irregularly in the degenerated nuclei. At the early stage of the degeneration the nuclei showed high affinity to hematoxylin and eosin, while at the later stage the nuclei became very small and showed low affinity to the dye. The degenerative large lymphoid cells such as macrophages and reticular cells are shown in Fig. 17. Their cytological aspects were identical with those of the same elements in the medulla of the thymus.

The lamina propria of the gut.

In the lamina propria, the lymphoid cells were scattered in abundance. Among them there were large lymphoid cells with oval pale nuclei. They may be comparable with the reticular cells of the thymus and spleen.

Cytological aspects of the degenerative lymphocytes and of the large lymphoid cells were the same as those found in the cortex of the thymus and in the white pulp of the spleen, that is, the nuclei showed pycnotic fragmentation, the cytoplasm did not swell and was stained weakly with eosin (Figs. 18, 19 and 30). The degenerative plasmacytes in this area contained a few cytoplasmic vacuolations. With advanced degeneration, their nuclei became segmented into three or four nuclear debris and decreased their affinity to hematoxylin, and at the same time their cytoplasm decreased its affinity to Azure II and was stained with eosin (Fig. 20).

2. The cytochemical observations of the degenerative lymphoid cells.

Polysaccharides, RNA, lipids and mitochondria were observed on the degenerative lymphoid cells which appeared in the mammary tissues, thymus, spleen, ileum and duodenum. The results are given in Table 1.

Table 1. The cytochemical aspects of the degenerative lymphoid cells in various tissues.

			Neutral muco- polysaccharides	RNA	Lipids	Mito- chondria
Mammary gland	Alveoli	Small lymphocytes	++~##	-	-~+	+~##
		Large lymphoid cells in 1st type	+~##	##~##	+~##	##~##
		Large lymphoid cells in 2nd type	##	-	+~##	##~##
	Interstitialium	Small lymphocytes	+	-	-	+
		Large lymphoid cells in 1st type	-~+	+~##	-~##	+~##
		Large lymphoid cells in 2nd type	+~##	-	-~##	+~##
Plasmacytes		+~##	-~+	-	+	
Thymus	Thymocytes	-~+	-	-	+	
	Large lymphoid cells	-~+	-~+	-	+	
	Plasmacytes	-~+	-~+	-	+	
Spleen	Lymphocytes	-~+	-	-	+	
	Large lymphoid cells	-~+	-~+	-	+	
	Plasmacytes	-~+	-~+	-	+	
Gut	Lymphocytes	-~+	-	-	+	
	Large lymphoid cells	-~+	-~##	-	+	
	Plasmacytes	-~+	-~+	-	+	

Note: The large lymphoid cells in the thymus, spleen and gut contain the monocytes, free macrophages and reticular cells.

Polysaccharides.

PAS positive substance was found in the cytoplasm of the degenerative lymphoid cells which appeared in any organ.

In the mammary alveoli, the degenerative large lymphoid cells in the first and second type and small lymphocytes occurred. The ones in the second type and the small lymphocytes were stained strongly by the PAS method (Fig. 25), while those in the first type were moderately stained peripherally or partly in their cytoplasm.

In the glandular epithelia and intralobular connective tissue area, the degenerative large lymphoid cells in the second type and small lymphocytes were found at any stage. They were stained weakly or moderately by the PAS method, and some of the cells which appeared at the post-weaning were stained strongly.

The degenerative lymphoid cells which appeared in the thymus, spleen, ileum and duodenum were stained weakly as a whole by the PAS method, but some of them, especially the ones which occurred in the medulla were stained moderately.

The PAS reactive substance was not digested by the saliva (37°C, 2 hours) and showed no metachromatical reaction with toluidine blue. Therefore, it was found to be neutral mucopolysaccharides other than glycogen.

RNA.

Stained with toluidine blue, fine granules of purplish blue color were demonstrated in the cytoplasm of the degenerative large lymphoid cells and plasmacytes in the mammary tissues. Since these granules disappeared after the treatment with the ribonuclease (37°C, 1 hour), they were RNA.

The degenerative large lymphoid cells in the second type and small lymphocytes which appeared in the mammary alveoli contained no RNA (Fig. 26), but the cells in the first type had much RNA (Fig. 23). The same cells found in the glandular epithelia and interstitium contained a slight amount of RNA.

The degenerative large lymphoid cells and plasmacytes in the lymphoid organs and gut had a small amount of RNA, while the degenerative lymphocytes contained no RNA.

Lipids.

Lipids stainable with the propylene glycol-sudan black B were found in the cytoplasm of the degenerative small and large lymphoid cells in the mammary alveoli (Fig. 24). Some of the same cells in the glandular epithelia and interstitium of the gland at the post-weaning contained lipid granules. However, the majority of the cells at the farrowing and mid-lactation stages contained no lipids.

The degenerative lymphoid cells found in the other organs such as thymus, spleen and gut contained no lipid granules.

Mitochondria.

Granular shaped mitochondria were scattered in the cytoplasm of the degenerative lymphoid cells which appeared in any organ. They were abundant in the cells found in the mammary alveoli, moderate in the cells found in the glandular epithelia and scanty in the intralobular connective tissue area, lymphoid organs and gut.

3. *The degenerative lymphoid cell counts in the mammary tissues, thymus, spleen and gut.*

As the third step of this investigation, the degenerative lymphoid cells in the interstitium, epithelia and lumina of the mammary gland were counted at the immediate post-partum, mid-lactation and at the second day of post-weaning. The results are given in Table 2.

Table 2. The degenerative lymphoid cell counts in the mammary tissues at various stages.

	Immediate post-partum	Mid-lactation	2nd day of post-weaning
Interstitium	$2.8 \pm 0.22^*$	$0.3 \pm 0.89^*$	$14.0 \pm 3.99^*$
Epithelia	2.0 ± 1.32	1.5 ± 0.57	20.0 ± 5.04
Lumina	7.2 ± 2.26	2.2 ± 1.85	13.6 ± 4.20
Colostrum bodies containing RNA in per cent	74	71	8

Note: Each cellular element is counted from 50 alveoli. Interstitium indicates the intralobular connective tissue area at the distance of 10μ from the alveolus.

*: Confidence interval ($\alpha=0.05$).

As shown in Table 2, a considerable number of the degenerative lymphoid cells was found in the intralobular connective tissue area, glandular epithelia and glandular lumina at any stage. The ones which appeared in the glandular lumina were the so-called colostrum bodies. There were no significant differences between the degenerative lymphoid cell counts in the interstitium and glandular epithelia at the immediate post-partum and mid-lactation. However, the cell counts in these regions at the second day of post-weaning were much larger than those at the other two stages.

The degenerative lymphoid cell counts in the glandular lumina was numerous at the immediate post-partum and the second day of post-weaning. It was noticed that the percentage of the so-called colostrum bodies containing RNA

was higher at the immediate post-partum and mid-lactation than at the second day of post-weaning.

Table 3. The degenerative lymphoid cell counts in the thymus, spleen, ileum and duodenum.

		Resting	Immediate post-partum	2nd day of post-weaning
Thymus	Cortex	34 ± 11.6*	56 ± 4.7*	28 ± 4.5*
	Medulla	24 ± 5.0	53 ± 7.5	31 ± 3.1
Spleen	White pulp	38 ± 9.2	50 ± 16.8	41 ± 12.2
	Red pulp	77 ± 32.3	207 ± 52.0	154 ± 64.0
Duodenum		25 ± 4.0	40 ± 3.3	26 ± 6.0
Ileum		16 ± 3.2	41 ± 21.0	28 ± 9.6

Note: Each cellular element is counted from 50 fields, one field is $36\mu^2$.

*: Confidence interval ($\alpha=0.05$).

The degenerative lymphoid cell counts in the thymus, spleen, ileum and duodenum are presented in Table 3. In any organ there were no significant differences between the cell counts at the resting and post-weaning stages. It was noticed that, however, the cell counts in any organ at the immediate post-partum were larger than those at the other two stages.

Discussion

The first object of the present investigation is to ascertain whether there is any cytological and cytochemical differences among the degenerative lymphoid cells which occurred in the mammary tissues, lymphoid organs and gut.

Confining attention to the cytological nature of the degenerative lymphoid cells, two types of cytoplasmic degeneration were recognized; first, the degenerative cells in the mammary alveoli at any stage, in the glandular epithelia and intralobular connective tissue at the post-weaning stage and in the medulla of the thymus at any stage had swollen cytoplasm containing vacuolations; second, those in the cortex of the thymus, in the white pulp of the spleen and in the lamina propria of the gut had shrunk cytoplasm. The difference mentioned above will be partially explained as follows. The cells of the first are freely suspended in the secreted milk or relatively large amount of body-fluid, accordingly the cytoplasm of the cells may be affected by their surrounding medium. On the contrary, however, the cells of the second are closely packed with the surrounding constituents, the tissue elements such as the lymphocytes, reticular framework and so forth, accordingly their cytoplasm may not be affected by their surrounding medium.

The nuclei of the degenerative lymphoid cells in various organs took pycnotic fragmentation except the degenerative lymphocytes that appeared in the red pulp of the spleen, where the nuclei showed no fragmentation in the process of disintegration and were stained sharply with eosin.

Confining attention to the cytological nature of the degenerative lymphoid cells, the interesting facts obtained were as follows. The large lymphoid cells in the first type within the secreted milk in the mammary alveoli contained a remarkable amount of RNA, even in the advanced stage of degeneration. The degenerative large lymphoid cells in the first type in the intralobular connective tissue area also contained a moderate amount of RNA in the early stage of degeneration. On the other hand, the degenerative large lymphoid cells which appeared in the other organs such as thymus, spleen and gut contained a slight amount of RNA or none of it in the early stage of degeneration, and they lost it with advanced degeneration.

At any rate, it was noticed that the typical colostrum bodies in the mammary alveoli which had vacuolated swollen cytoplasm contained a large amount of RNA and a small amount of neutral mucopolysaccharides, lipids and mitochondria, while the degenerative lymphoid cells in the other parts of the mammary gland and the other organs which had no swollen cytoplasm contained a slight amount of the same substances.

As to the degenerative large lymphoid cells in the second type which contained a large amount of neutral mucopolysaccharides and no RNA, it was suggested that they were the degenerating pictures of the large lymphoid cells containing no RNA, especially of large lymphocytes. Indeed, the same cells and the large lymphocytes in the successive stage of the degeneration appeared abundantly, together with the neutrophils, in the mammary alveoli as well as in the interstitium during the regression and inflammation stages of the gland.

Okada(10) reported that the lipid substance contained in the cytoplasm of the colostrum bodies may be a fatty degenerative product of the cell themselves rather than foreign nature. The idea just stated seemed to be in good agreement with the results of this investigation, because the degenerative lymphoid cells with fatladen cytoplasm were found in the mammary alveoli which contained no secreted milk, and in some cases, even in the glandular epithelia and intralobular connective tissue area where the lipid substance was not present.

Okada(11) reported that an increase of the wandering leucocytes in the mammary tissues at the post-weaning seemed to be related to the regression and inflammation of the gland. In the present investigation, many degenerative large lymphoid cells containing no RNA were also found in the mammary tissues at the post-weaning. On the contrary, however, the cells which appeared in the mammary alveoli at the farrowing and mid-lactation stages were composed of many large lymphoid cells containing much RNA. Therefore, these

degenerative large lymphoid cells containing RNA seem to be typical colostrum bodies. Thus, it was noticed that the cells that appeared in the mammary alveoli at the post-weaning differed in their nature and origin from those at the farrowing time.

Dougherty and White (4, 5) reported that the lymphoid organs showed a degenerative change after an injection of pituitary adrenocorticotrophic hormone or adrenal cortical preparations and concluded that these changes were characterized by pycnosis and shedding of the cytoplasm of the lymphocytes. Poulton and Reece(13), Andersen and Sperry(1) and Schultze(14) reported that a sharp increase in the activity of the pituitary-adrenal system occurred during parturition. It was found in this investigation that the degenerative lymphoid cells that appeared in the thymus, spleen, ileum and duodenum were more numerous at the farrowing time than at the resting and post-weaning stages.

If the relations just stated are accepted in the present investigation, the increased occurrence of the degenerative lymphoid cells in the thymus, spleen, ileum and duodenum and also of the colostrum bodies in the mammary alveoli at the farrowing time may be interpreted under the increased activity of the pituitary-adrenal system. This will be fully discussed in an other paper of this series.

Summary

The results in this investigation are summarized as follows.

1. The degenerative lymphoid cells found in the mammary alveoli had largely swollen cytoplasm and contained much RNA, moderate neutral mucopolysaccharides, lipids and mitochondria. While the cells found in the lymphoid organs and gut had no swollen cytoplasm and contained a slight amount or none of these substances. These morphological differences seemed to be due to the site where the degeneration occurs.

2. In the mammary tissues, the degenerative lymphoid cells found at the farrowing and mid-lactation stages contained much RNA. These cells were shown as typical colostrum bodies. While the majority of the cells found at the post-weaning stage contained a great amount of neutral mucopolysaccharides and no RNA. At this stage the same cells were also found in the interstitium and epithelia of the gland. These cells were explained in relation with a regression of the gland.

3. The degenerative lymphoid cells appeared abundantly in the lymphoid organs and gut at the farrowing time when the colostrum bodies also increased. This may be interpreted under an increased activity of the pituitary-adrenal system.

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Plate 1**Explanation of Figures**

All figures show the degenerative lymphoid cells which appeared in the mouse mammary tissues at the immediate post-partum and second day of post-weaning. $\times 3000$. Drawn (Maximow's stain).

- Fig. 1. The large lymphoid cells in the mammary alveoli. These cells have the swollen cytoplasm containing azurphilic granules. They appear abundantly at the post-partum.
- Fig. 2. The lymphocytes in the mammary alveoli. These cells have swollen cytoplasm stained deeply with eosin and contain no azurphilic granules.
- Fig. 3. The large lymphoid cells in the mammary alveoli. These cells have swollen cytoplasm stained deeply with eosin and contain no azurphilic granules. They appear abundantly at the post-weaning.
- Fig. 4. The large lymphoid cells in the glandular epithelia and interstitium. These cells have moderately swollen cytoplasm and contain azurphilic granules. They appear rarely at every stage.
- Fig. 5. The small lymphocytes in the intralobular connective tissue and glandular epithelia. These cells have no swollen cytoplasm and contain no azurphilic granules. They appear rarely at every stage.
- Fig. 6. The vacuolated degenerative plasmacytes in the interstitium at the regression stage of the gland. Their vacuolations are stained with eosin.
- Fig. 7. The large lymphoid cells in the interstitium. These cells have no swollen cytoplasm and are stained weakly with eosin. They appear abundantly at the regression stage of the gland.

Plate 1

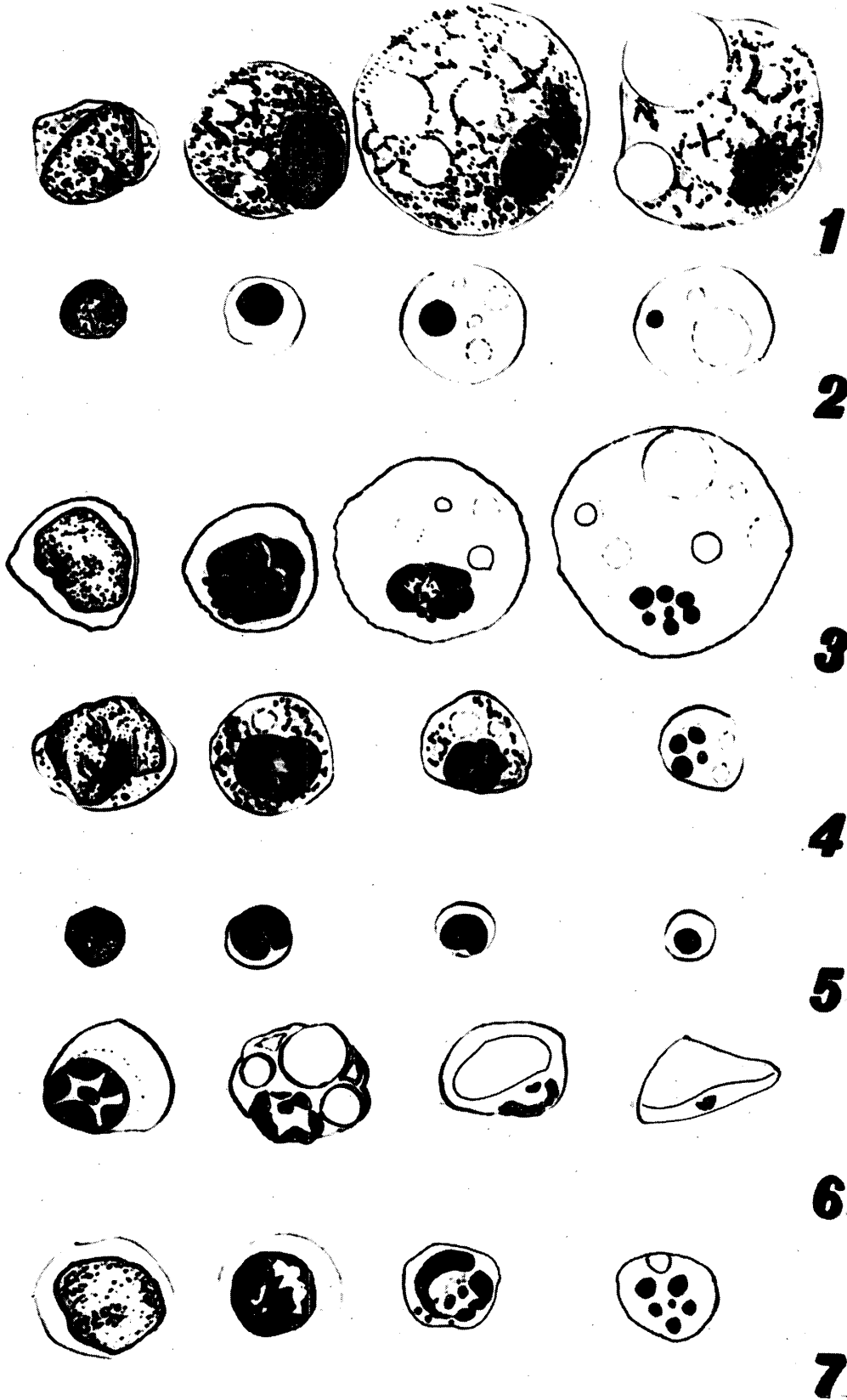


Plate 2**Explanation of Figures**

All figures show the degenerative lymphoid cells which appeared in the thymus of mice. $\times 3000$. Drawn (Maximow's stain).

- Fig. 8. The small thymocytes in the cortex. These cells have shrunk cytoplasm stained very faintly with eosin.
- Fig. 9. The large thymocytes in the cortex. These cells have pycnotic subdivided nuclear debris and shrunk cytoplasm stained faintly with eosin.
- Fig. 10. The small thymocytes in the medulla. These cells have moderately swollen cytoplasm containing vacuolations and are stained moderately with eosin.
- Fig. 11. The large thymocytes in the medulla. These cells have moderately swollen cytoplasm containing vacuolations and are stained moderately with eosin.
- Fig. 12. The vacuolated degenerative plasmacytes in the medulla. Their vacuolations are stained faintly or weakly with eosin. When the vacuolations were numerous the cytoplasm shows the hive-like picture. They appear rarely.
- Fig. 13. The degenerative large lymphoid cells in the medulla. These cells have shrunk cytoplasm stained very weakly with eosin and contain highly subdivided nuclear fragments.

Plate 2

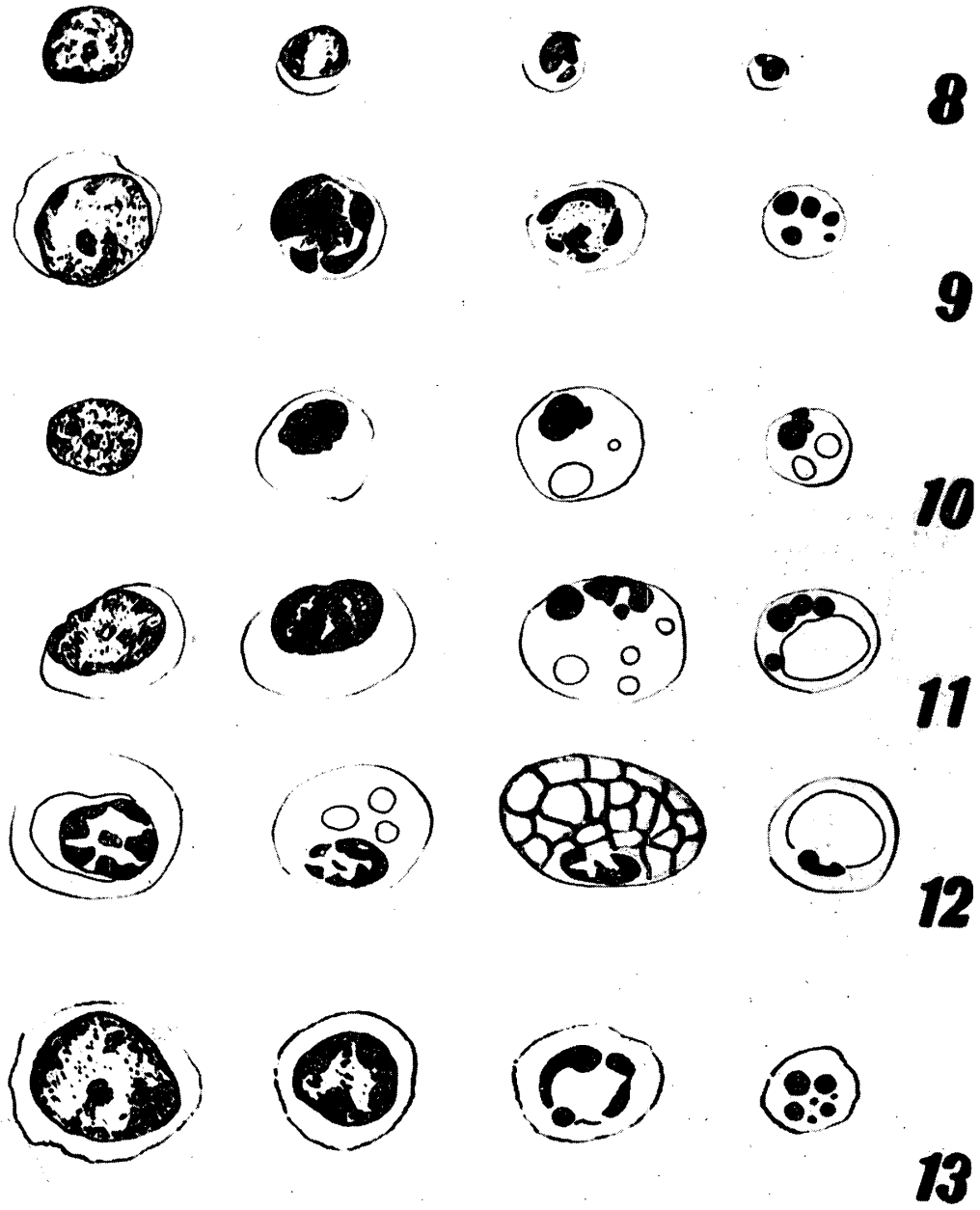


Plate 3**Explanation of Figures**

All figures show the degenerative lymphoid cells which appeared in the spleen and gut. $\times 3000$. Drawn (Maximow's stain).

- Fig. 14. The lymphocytes in the white pulp of the spleen. Their cytological nature is the same as those in the cortex of the thymus.
- Fig. 15. The large lymphoid cells in the white pulp of the spleen. Their cytological nature is the same as those in the cortex of the thymus.
- Fig. 16. The lymphocytes in the red pulp of the spleen. These cells have no cytoplasm and their nuclei are stained diffusibly with hematoxylin and eosin. The nuclei contain irregular shaped chromatin threads.
- Fig. 17. The large lymphoid cells in the red pulp of the spleen. Their cytological nature is the same as those in the medulla of the thymus.
- Fig. 18. The lymphocytes in the lamina propria of the gut. Their cytological nature is the same as those in the cortex of the thymus.
- Fig. 19. The large lymphoid cells in the lamina propria of the gut. Their cytological nature is the same as those in the cortex of the thymus.
- Fig. 20. The degenerative plasmacytes in the lamina propria of the gut. These cells contain a few cytoplasmic vacuolation and are stained faintly with eosin.

Plate 3

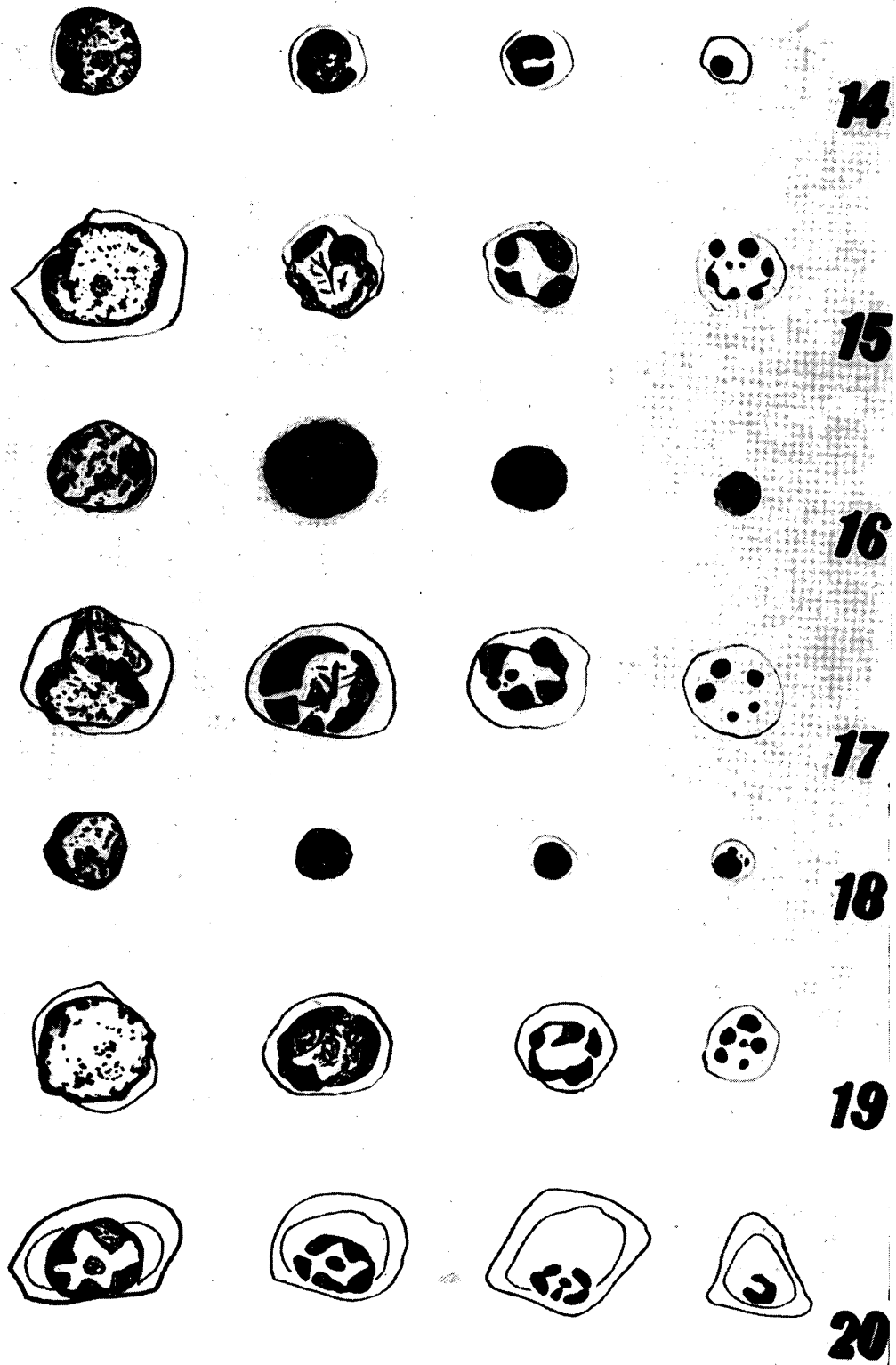


Plate 4**Explanation of Figures**

- Fig. 21. The colostrum body-like degenerative large lymphoid cells which appeared in the interstitium of the regression stage of the gland. They have largely swollen cytoplasm containing vacuolations and are stained deeply with eosin. $\times 1800$. Maximow's stain.
- Fig. 22. The degenerative lymphoid cells which appeared within the glandular epithelia at the regression stage of the gland. Their cytological nature is the same as those in the mammary alveoli. $\times 1800$. Maximow's stain.
- Fig. 23. The colostrum bodies containing much RNA in the mammary alveoli at the immediate post-partum. $\times 1800$. Toluidine blue stain.
- Fig. 24. The colostrum body containing lipid granules and cytoplasmic vacuolations in the mammary alveoli at the regression stage. $\times 2000$. Propylene glycol-sudan black B stain.
- Fig. 25. The colostrum bodies containing neutral mucopolysaccharides in the mammary alveoli at the regression stage of the gland. $\times 1800$. PAS stain.
- Fig. 26. The colostrum body containing no RNA in the mammary alveoli at the regression stage of the gland. $\times 1800$. Toluidine blue stain.

Plate 4

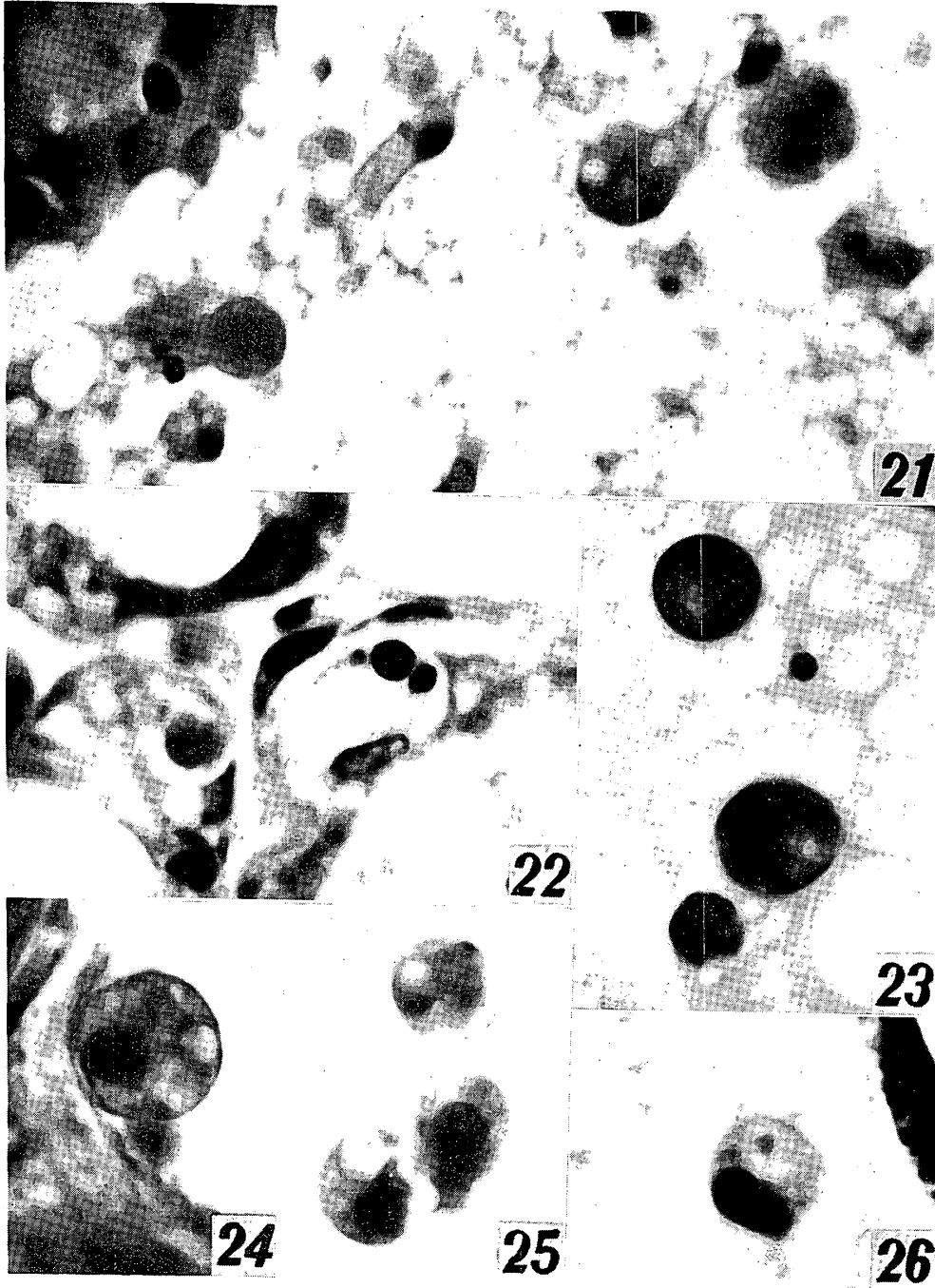


Plate 5**Explanation of Figures**

All figures show the degenerative lymphoid cells (indicated by arrows) in various organs. $\times 2500$. Maximow's stain.

- Fig. 27. The degenerative lymphoid cells in the medulla of the thymus. Pycnotic nuclei and moderately swollen cytoplasm are seen.
- Fig. 28. The degenerative lymphoid cells in the white pulp of the spleen. Pycnotic nuclear debris and shrunk cytoplasm are seen.
- Fig. 29. The degenerative lymphocytes in the red pulp of the spleen. Nuclei stained diffusibly with hematoxylin and eosin are seen.
- Fig. 30. The degenerative lymphoid cells in the lamina propria of the duodenum. Pycnotic subdivided nuclear debris are seen.

Plate 5

