It would seem that if the liver is the only source of the potassium mobilized in response to the stimulation of epinephrine[3] it probably continues to release it during the entire time when the epinephrine level of the blood is elevated. However, the liver, as well as the other tissues, very rapidly begins removing potassium from the blood and at such a rate that the blood potassium level is depressed appreciably below the resting normal. The mechanism by which this is accomplished is not clear and whether it depends upon metabolic or purely vascular factors cannot be said at this time.

Summary. During infusion of 1:75,000 epinephrine for as long as 45 minutes at the rate of 1 ml per minute the potassium content of the blood entering the liver, although actually below the resting concentration still exceeds that of blood leaving the liver. This strongly suggests that the cell source from which potassium is mobilized by epinephrine takes part, at least, in removing the excess from the circulation.

11649

Thymus and Lymph Nodes Following Adrenalectomy and Maintenance with NaCl in the Rat.*

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The existence of a relationship between the thymus gland and the adrenal cortex has been well established. Adrenalectomy has been reported as causing thymic regeneration,[1] and it has been shown that the inability of the thymus to undergo involution in response to alarming stimuli after this operation is not altered by the administration of sodium chloride.[2] Cortin[3] and adrenocorticotropic hormone[4] have been shown to cause thymic involution. Clinical reports

[3] D'Silva, J. L., *J. Physiol.*, 1936, **87**, 181.

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[1] Jaffe, H. L., *J. Exp. Med.*, 1924, **40**, 325.

[2] Selye, H., *Brit. J. Path.*, 1936, **17**, 234.

[3] Ingle, D. J., PROC. SOC. EXP. BIOL. AND MED., 1938, **38**, 443.

[4] Evans, H. M., Moon, H. D., Simpson, M. E., and Lyons, W. R., PROC. SOC. EXP. BIOL. AND MED., 1938, **38**, 419.

would seem to indicate a relationship between conditions of adrenal cortical hypofunction and enlargement of thymus and lymphoid tissue. It has been shown in certain species, particularly the rabbit[5] and the rat,[6] that the lymph nodes undergo quantitatively a type of weight involution similar to that of the thymus gland.

In this connection it was of interest to determine whether or not the other lymphoid tissue of the body would exhibit a reaction after adrenalectomy similar to that of the thymus. The use of sodium chloride as a means of prolonging the life of adrenalectomized animals has also prompted an inquiry into the effect of this treatment on thymus and lymphoid tissue of normal and adrenalectomized rats.

Methods. 60-day-old normal male rats of the Long-Evans strain were divided as evenly as possible into the following littermate groups. (1) 60 animals were subjected to a one-stage bilateral adrenalectomy under ether anesthesia using the lumbar approach. Immediately after operation, this group was given 1% NaCl solution as drinking water. Of this number, 44 animals survived the 45-day experimental period and showed no macroscopically visible evidence of adrenal cortical tissue at autopsy. (2) 34 animals were maintained on 1% NaCl solution as salt control animals. (3) 30 animals received ordinary tap water for drinking purposes. All 3 groups were maintained for 45 days under the same experimental conditions, receiving the standard stock diet in use in this laboratory. The animals were autopsied at the age of 105 days at which time they were sacrificed by bleeding under ether anesthesia. The thymus gland of the entire series and the lymph nodes and spleens of representative animals were dissected out, weighed, and fixed for histological study. Dissection of the lymph nodes followed the description given by Job,[7] with some additions, and included cervical, axillary, superior mediastinal, epitrochlear, abdominal and mesenteric groups. All nodes except the mesenteric are grouped under the general heading of systemic nodes. The lymph nodes are constant in position, vary mainly in the subdivisions of the nodes, and are easily dissected. All the nodes and thymus glands were dissected according to a definite routine by the same person to avoid variation.

Results. Table I presents the data obtained.

Inspection of the table shows that the thymus and lymphoid tissues are heavier in the adrenalectomized animals than in the controls.

5 Hellman, T., *Upsala Läk. För.*, Suppl., 1914, May 1.

6 Chiodi, H., *Endocr.*, 1940, **26**, 107.

7 Job, T., *Anat. Rec.*, 1915, **9**, 447.

TABLE I.
Thymus and Lymph Nodes.

Type of animal	Thymus			Lymph Nodes			
	No. of animals	Avg B.W.	Thymus wt	No. of animals	Avg B.W.	Systemic nodes	Mesenteric nodes
Normal	20	343	190±12*	7	335	545±40*	366±37*
NaCl Controls	34	340	229±10	6	334	470±32	335±39
Adrenalec. on NaCl	44	303	344±11	11	322	1028±60	440±15

*Weights in mg ± standard error of mean.

The increase in weight is statistically significant as determined by the usual calculations involving standard errors of the differences of the means. Sodium chloride *per se* would seem to cause slight increase in the weight of thymus and the reverse effect on the lymph nodes. The differences are, however, not significant in this number of animals.

It will be noted that the response of the systemic lymph node tissue to adrenalectomy is similar to and even more pronounced than that of the thymus gland. Mesenteric nodes, however, show this response in a more limited manner. The spleen reacts in a manner similar to the thymus and systemic nodes. The figures for this organ are not included because of the incidence of Bartonella infection in the colony.

Histological examination of representative hematoxylin and eosin stained celloidin sections of the thymus and lymphoid tissues of the various groups show that the heavier weight of these tissues in the adrenalectomized animals is due to an actual increase in the bulk of the elements normally present and not to any specific morphological change.

While the above experiments confirm the finding of thymic and lymphoid enlargement noted clinically in Addison's disease and experimentally in adrenalectomized animals, we feel that the use of animals maintained on sodium chloride allows one to study the effects of lack of adrenal cortical hormone uncomplicated by disturbance in electrolyte balance and metabolism as found in the adrenalectomized animal. It should be emphasized that the animals studied after adrenalectomy and maintenance on sodium chloride are to all outward appearances perfectly normal at time of autopsy. The above findings suggest that the thymus gland, systemic lymph nodes, and the spleen react in much the same way to the effects of adrenalectomy. Whether or not this relationship holds true in other experimental conditions is under investigation with the view of determining any further identity of function which may exist in these morphologically related tissues.

Summary. 1. The thymus gland of adrenalectomized male rats maintained for 45 days on sodium chloride does not undergo the involution characterizing the gland in normal untreated animals or those treated with sodium chloride. Sodium chloride as employed appears to exert no consistent effect *per se* on the thymus or lymphoid tissues of the unoperated control. 2. The systemic lymph nodes of adrenalectomized animals maintained on sodium chloride were heavier than those of normal untreated animals or normal animals given sodium chloride. It is notable that the mesenteric lymph nodes do not undergo a comparable gravimetric increase.

11650 P

Effects of Progesterone Upon the Uterus of the Mouse.*

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The fragmentary understanding of the involvement of the corpus luteum in various phases of reproductive activity in the rat and mouse seems in no small measure to be attributable to the inadequacy of the available criteria of activity of the corpus luteum. It seems that no morphologic uterine response to progesterone has been reported for the mouse, and in the rat apparently the only reported effect is mitosis in the epithelium.[1] In the course of a study of the healing of uterine wounds,[2] a definite morphologic response was observed in the uteri of ovariectomized mice receiving progesterone. The experiments described here were conducted to examine the possibility indicated by that observation.

Only young adult mice of the Strong NH strain were used. All the animals were ovariectomized and a period of 3 weeks elapsed between operation and the start of treatment. One group of 6 mice was given daily injections of 0.25 mg of progesterone,† and another group of 6 received 0.5 mg of progesterone daily. Three animals

* This study was aided by a grant from the Fluid Research Fund of Yale University School of Medicine.

1 Hisaw, F. L., Greep, R. O., and Fevold, H. L., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 840.

2 Hooker, C. W., *Anat. Rec.*, in press.

† Supplied by Ciba Pharmaceutical Products, Inc., through the courtesy of Mr. R. C. Mautner.