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Cytological Study Concerning the Effects of the Adrenal Cortical Hormone on the Secretory Activity of the Gastric Peptic Cells.

副腎皮質ホルモンが胃腺主細胞分泌機能に及ぼす
影響に関する細胞学的研究

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As a result of the experiments by FUJIE et al. in which the anastomosis of the oesophagus and the jejunum in dogs was performed so that the stomach might be isolated from the diet eaten, the following facts were made manifest viz. 1. both the discharge of the gastric hormone *productin* and the secretory ability of the gastric peptic cells are very minor even after administration of the diet, 2. the histamine values in the blood are extremely low and inconsistent with the discharge of the histamine-like *productin* and the secretory ability of the peptic cells, and 3. the cortical hormone of the suprarenal glands seems to be discharged in considerable quantity.

The extremely low quantity of histamine in the blood in this case may be explainable by the low secretion of *productin* and the anti-histamic action of the saliva secreted (FUJIE). However the relationship between the extremely low quantity of histamine and the secretory activity of the gastric peptic cells can not be explained by the *productin* theory of FUJIE. FUJIE has found that the cortical hormone of the suprarenal glands was discharged more copiously in the dogs of the above experiments than in normal dogs, and he suggested that the cortical hormone might be related to the above inconsistency.

Here, the author attempted to test whether or not the cortical hormone of the suprarenal glands has any effect upon the secretory activity of the gastric peptic cells.

I. Materials and Methods.

Adult and male rats accustomed to a regular feeding of Mc COLLUM's artificial diet for more than one week were used for the following experiments.

1. Hydrocortisone 1 mg, 5 mg, 10 mg per 1 kg of the animal's weight was injected subcutaneously before administration of the diet. Then the diet was given. Samples were taken on the next day when the rats were still unfed and at periods of $\frac{1}{2}$, 1, 2, 3 hrs. after the diet.

2. Hydrocortisone 1 mg/kg, 5 mg/kg, 10 mg/kg was injected subcutaneously every day while the rats were still unfed then the diet was given. The injection was repeated for 5 days and 10 days. On the day after the last injection, samples were taken at the same periods as above 1.

3. The total extirpation of the suprarenal glands was performed. On the day after the operation and on the 5th day after the operation, samples were taken before the diet was given and at periods of $\frac{1}{2}$, 1, 2, 3 hrs. after the diet.

4. After the total extirpation of the suprarenal glands, hydrocortisone 10mg/kg was injected subcutaneously before the diet was given for 5 days. On the 6th day, samples were taken at the same periods as above 3.

5. After the total extirpation of the suprarenal glands, anthranilic acid 10mg/kg was injected subcutaneously before administration of the diet for 5 days. On the 6th day, samples were taken at the same periods as above.

To take samples, the thorax was opened under deep ether narcosis and LUNA's liquid was injected into all arteries from the left heart ventricle for the vital fixation. Small pieces were taken from the glandular portion of the stomach and they were placed in KOLSTER's liquid for the post-fixation. Paraffin sections of 4μ were made and stained by HEIDENHAIN's iron haematoxylin.

II. Observations.

The results obtained from the microscopic observation were tabulated by the method which is usually used in FUJIE's laboratory. Viz. on the surface cells of the gastric mucous membrane, the quantity of *productin* vacuoles (FUJIE) was marked + + + when the vacuoles filled up the under-half of the cell body and was marked + + + + when they were more copious and was marked - when no vacuoles could be seen. And then three intervening steps of + +, +, $\pm$ were made suitably between + + + and -. In the gastric peptic cells in the base of the gastric glands, the quantity of secretory granules or of vacuoles was marked + + + when the upper half of the cell body was full of them, was marked - when no granules or vacuoles were seen, and between + + + and - the three intervening steps of + +, +, $\pm$ were used. Besides them the form of plastosomes and the aspect of the gland lumen were described so that the secretory activity of the peptic cells might be easily observed.

Table 1. Subcutaneous injection of 1mg/kg hydrocortisone.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	$\pm \sim$ ++(+)	$\pm \sim ++$	long rod, short rod, rosary form	$\pm \sim ++$	$\pm \sim +$	narrow, a little wide	$+\sim$ ++++	$+\sim ++ +$
$\frac{1}{2}$	$-\sim$ +(+)	$\pm \sim +++ +$	long rod, short rod	$\pm \sim +$ —	$\pm \sim +$ +++	a little wide, narrow	$-\sim$ +++	$-\sim ++ +$
1	$\pm \sim ++ +$	$\pm \sim ++ +$	short rod, long rod	$\pm \sim ++ +$	$\pm \sim +(+) +$	a little wide, narrow	$-\sim$ +++	$\pm \sim ++ +$
$1\frac{1}{2}$	$-\sim \pm$	$\pm \sim ++ +$	short rod, long rod	$-\sim \pm$	$\pm \sim +$	wide, a little wide	$+\sim$ ++++	$\pm \sim ++ + +$

2	—~++	±~++	long rod, short rod	±~++ —	±~++ ++	narrow, a little wide	—~ +++	±~+++
3	±~++	±~+	short rod, long rod	< ±~++	±~+	wide, a little wide	+~ +++	+~+++

Table 2. Subcutaneous injection of 5 mg/kg hydrocortisone.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	± ~ + +	± ~ + +	short rod, long rod, rosary form	+ ~ + +	± ~ + (+)	narrow	± ~ + + +	± ~ + + +
½	- ~ + +	± ~ + + (+)	long rod, short rod, rosary form	+ ~ + + - ~ +	± ~ + + + ~ + + (+)	a little wide, narrow	+ ~ + + +	+ ~ + + +
1	± ~ + +	± ~ + +	short rod, rosary form, long rod	± ~ + +	± ~ +	a little wide, narrow	± ~ + + +	± ~ + + +
1 ½	- ~ + +	± ~ + + (+)	short rod, long rod, rosary form	+ ~ + + - + +	± ~ + + + ~ + + (+)	a little wide, narrow, (wide)	- ~ + + +	± ~ + + (+)
2	- ~ + +	± ~ + + (+)	short rod, rosary form, long rod	± ~ + + - + +	± ~ + + + ~ + + (+)	a little wide	± ~ + + +	± ~ + + +
3	+ ~ + + +	± ~ + + (+)	short rod, guitar form, long rod	+ +	± ~ +	a little wide	+ ~ + + +	+ ~ + + +

Table 3. Subcutaneous injection of 10 mg/kg hydrocortisone.

Be-fore	±~++	±~+	short rod, guitar form, rosary form, long rod	+~++	±~+	narrow, a little wide	—~ +++	±~+++
½	±~++	±~ ++(+)	short rod, long rod, rosary form	< ±~+	±~+(+)	a little wide, narrow	—~ +++	±~ ++(+)
1	±~++	±~++	short rod, long rod, rosary form	+~++	+	a little wide	—~ +++	±~ ++(+)
1½	±~++	±~++	short rod, long rod, short rosary form	+~++ ±	±~+ +~++	a little wide	—~ +++	±~+++
2	±~++	±~++	short rod, long rod	±~+(+)	+~++	a little wide, wide, narrow	±~ +++	+~+++
3	—~ +++	±~+++	short rod, short rosary form, long rod, guitar form	+~++++ —~±	±~+ ++~+++	a little wide, wide	+~ +++	+~+++

Table 4. Subcutaneous injections of 1 mg/kg hydrocortisone for 5 days.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	± ~ + + +	± ~ + + +	short rod, long rod, rosary form	+ ~ + + +	± ~ +	wide, a little wide	± ~ + + + +	± ~ + + + +
½	- ~ + + +	± ~ + + +	short rod, guitar form, short rosary form	+ + (-	± ~ + + +)	wide, a little wide	- ~ + + +	± ~ + + + +
1	- ~ + + +	± ~ + + + +	short rod, long rod, guitar form, rosary form	+ ~ + + + + (- ~ ± + + + ~ + + + +)		a little wide, wide, narrow	± ~ + + +	+ ~ + + +
1 ½	- ~ + + +	± ~ + + +	short rod, rosary form, long rod	+ ~ + + + + - ~ ±	± ~ + + +	a little wide, wide	± ~ + + +	+ ~ + + + +
2	- ~ + + +	± ~ + + + +	long rod, short rod	+ ~ + + + - ~ +	± ~ + + + ~ + + + +	a little wide, wide	+ ~ + + +	+ ~ + + + +
3	- ~ + + +	± ~ + + + +	long rod, short rod	- ~ + + ~ + + + +	+ ~ + + + + ± ~ +	a little wide	+ ~ + + +	+ ~ + + + +

Table 5. Subcutaneous injections of 5 mg/kg hydrocortisone for 5 days.

Be-fore	- ~ +++	± ~ +	short rod, long rod	+ ~ ++	± ~ +	wide, a little wide	+ ~ +++	+ ~ +++
½	- ~ ++	± ~ +++	short rod, long rod, rosary form	+ ~ ++ (- ~ ±	± ~ + + ~ +++)	a little wide, wide	± ~ +++	+ ~ ++(+)
1	- ~ ++	± ~ ++	long rod, short rod	± ~ ++ -	± ~ ++ ++	a little wide, wide	± ~ +++	+ ~ ++(+)
1 ½	- ~ ++	± ~ ++(+)	long rod, short rod, guitar form, rosary form	± ~ ++ -	± ~ ++ ++(+)	a little wide, wide, narrow	± ~ +++	+ ~ ++(+)
2	- ~ ++(+)	± ~ ++	long rod, short rod, short rosary form	+ - ~ ±	± ~ + + ~ ++	a little wide	- ~ +++	+ ~ +++
3	- ~ ++(+)	± ~ ++(+)	long rod, short rod	± ~ +	± ~ +	narrow, a little wide	- ~ +++	+ ~ ++(+)

Table 6. Subcutaneous injections of 10 mg/kg hydrocortisone for 5 days.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Before	- ~ +	± ~ + (+)	long rod, short rod, rosary form	±	± ~ + (+)	a little wide, wide	+ ~ +++	+ ~ + + +
½	- ~ +	± ~ + (+)	short rod, long rod	±	± ~ + (+)	a little wide, wide	- ~ +++	± ~ + + +
1	± ~ + +	± ~ + +	short rod, guitar form, short rosary form, long rod	± ~ + +	± ~ + +	a little wide, wide, narrow	± ~ +++	± ~ + + +
1 ½	- ~ +	± ~ + + +	long rod, short rod, guitar form	- ~ ±	< + ~ + + +	a little wide, narrow, wide	+ ~ +++	+ ~ + + +
2	- ~ + +	± ~ + + +	long rod, short rod, rosary form	- ~ ± - ~ ± (+ +	+ ~ + + + ± ± ~ +)	a little wide, narrow	+ ~ +++	+ ~ + + +
3	- ~ + (+)	± ~ + +	long rod, short rod, guitar form	± (+ ~ + (+)	± ~ + ±)	a little wide, narrow	± ~ +++	+ ~ + + +

Table 7. Subcutaneous injections of 1 mg/kg hydrocortisone for 10 days.

Be-fore	+ ~ + (+)	± ~ +	long rod, short rod	+	±	narrow, a little wide	+ ~ +++	+ ~ + + +
½	± ~ + +	± ~ +	short rod, long rod, rosary form	± ~ +	± ~ +	a little wide, wide	- ~ +++	± ~ + +
1	- ~ + +	± ~ + +	short rod, supra-short rod, guitar form, long rod, rosary form	± ~ + +	± ~ + +	a little wide	- ~ +++	+ ~ + +
1 ½	± ~ + +	± ~ + +	short rod, long rod, rosary form	+ ~ + +	± ~ + (+)	a little wide	+ ~ +++	+ ~ + + +
2	- ~ + +	± ~ + +	long rod, short rod, rosary form	± ~ + +	+ ~ + +	a little wide	+ ~ +++	+ ~ + + +
3	- ~ + +	± ~ + + +	long rod, short rod	- ~ + + ~ + +	+ ~ + + + ± ~ +	a little wide, wide	+ ~ +++	+ ~ + + +

Table 8. Subcutaneous injections of 5 mg/kg hydrocortisone for 10 days.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory Substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	± ~ + +	± ~ + (+)	long rod, short rod	± ~ + +	± ~ +	a little wide, wide	+ ~ + + + (+)	+ ~ + + +
½	± ~ + (+)	± ~ + (+)	long rod, short rod	± ~ ±	± ~ +	a little wide, wide	- ~ + +	± ~ + +
1	± ~ + (+)	± ~ + +	long rod, short rod, rosary form	± ~ +	± ~ + +	a little wide	- ~ + + (+)	± ~ + + (+)
1 ½	± ~ + + +	± ~ + +	long rod, short rod, guitar form	± ~ + +	± ~ + +	a little wide	- ~ + +	± ~ + +
2	± ~ + +	± ~ + +	long rod, short rod	± ~ + +	± ~ +	a little wide	± ~ + + +	± ~ + + +
3	- ~ + +	± ~ + + (+)	long rod, short rod	± ~ + + - + +	± ~ + (+) + ~ + + (+)	a little wide, wide	+ ~ + + +	+ ~ + + +

Table 9. Subcutaneous injections of 10 mg/kg hydrocortisone for 10 days.

Be-fore	$\pm \sim ++$	$\pm \sim ++$	long rod, short rod	$\pm \sim ++$	$\pm \sim ++$	a little wide, wide, narrow	$+ \sim$ $++++$	$+ \sim ++++$
$\frac{1}{2}$	$\pm \sim$ $+(+)$	$\pm \sim ++$	long rod, short rod	$\pm \sim +$	$\pm \sim +$	a little wide	$- \sim$ $++++$	$\pm \sim ++$
1	$- \sim ++$	$\pm \sim +$	long rod, short rod	$\pm \sim ++$	$\pm \sim +$	a little wide, wide	$- \sim$ $++++$	$\pm \sim ++++$
$1\frac{1}{2}$	$\pm \sim ++$	$\pm \sim +$	long rod, short rod	$\pm \sim ++$	$\pm \sim +$	a little wide, wide	$\pm \sim$ $++++$	$\pm \sim ++++$
2	$\pm \sim ++$	$\pm \sim +$	long rod, short rod	$\pm \sim ++$	$\pm \sim +$	a little wide, (wide)	$\pm \sim$ $++++(+)$	$+ \sim ++++$
3	$\pm \sim$ $++(+)$	$\pm \sim ++$	long rod, rosary form, short rod	$\pm \sim ++$	$\pm \sim +$	a little wide	$+ \sim$ $++++$	$+ \sim ++++$

Table 10. The day after the total extirpation of the suprarenal glands.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	- ~ +(+)	± ~ +	short rod, rosary form, long rod	± ~ +	± ~ +	narrow, a little wide	+ ~ +++	+ ~ + + +
½	+ ~ + + +	± ~ +	short rod, short rosary form, supra-short rod, long rod	+ +	± ~ +	a little wide, narrow	- ~ +++	± ~ + +
1	± ~ + + +	± ~ + + +	guitar form, short rod, supra-short rod, rosary form, long rod	+ ~ + + +	± ~ + + +	wide, a little wide	± ~ +++	± ~ + +
2	+ ~ + + +	± ~ + + +	guitar form, short rod, supra-short rod	+ (+) ~ + +	± ~ + + +	a little wide, wide	- ~ +++	± ~ + + (+)
3	± ~ + + +	± ~ + + +	short rod, rosary form, (long rod)	+ ~ + + +	± ~ +	a little wide, wide	± ~ +++	± ~ + + +

Table 11. 5 days after the total extirpation of the suprarenal glands.

Be-fore	- ~ ±	- ~ +	short rod, rosary form, guitar form, long rod	- ~ ±	± ~ +	a little wide, wide	+ ~ +++	+ ~ +++
½	- ~ ±	- ~ + (+)	short rod, rosary form, long rod	- ~ ±	± ~ +	wide, a little wide	- ~ +++	± ~ ++
1	- ~ ±	- ~ +	long rod, short rod, rosary form	-	±	very wide, wide	- ~ +++	+ ~ ++
2	± ~ +++	± ~ +++	short rod, rosary form, long rod	+ ~ +++	± ~ +++	a little wide	± ~ +++	± ~ +++
3	± ~ +++	± ~ +++	long rod, short rod, rosary form	± ~ +	± ~ +++	a little wide	+ ~ +++	+ ~ +++

Table 12. 10 mg/kg hydrocortisone was injected for 5 days after the total extirpation of the suprarenal glands.

Hrs. after the diet	The gastric peptic cells					Gland lumen	The surface cells	
	Total result			Representative result			Quantity of <i>productin</i> vacuoles in the cells	
	Quantity of the intracellular secretory substance		Form of plastosomes				Total result	Representative result
	Granules	Vacuoles		Granules	Vacuoles			
Be-fore	+ ~ + +	± ~ +	short rod, long rod, rosary form, guitar form	+ ~ + +	± ~ +	narrow, a little wide	- ~ + + +	+ ~ + + +
½	± ~ + + +	± ~ + +	short rod, long rod, guitar form, rosary form	++	± ~ + +	a little wide, narrow	- ~ + + +	± ~ + + (+)
1	- ~ + +	± ~ + +	short rod, long rod, guitar form, supra-short rod, rosary form	± ~ + +	± < ~ + +	a little wide, wide	- ~ + + +	± ~ + + +
2	± ~ + +	± ~ + (+)	long rod, rosary form, short rod, guitar form	± ~ + +	± ~ + (+)	a little wide, wide	- ~ + + +	± ~ + + (+)
3	± ~ + +	± ~ + +	long rod, short rod, rosary form	± ~ + +	± ~ + +	a little wide, wide	+ ~ + + +	+ ~ + + +

Table 13. 10 mg/kg anthranilic acid was injected for 5 days after the total extirpation of the suprarenal glands.

Before	- ~ ±	- ~ + (+)	short rod, long rod, supra-short rod, rosary form	- ~ ±	± ~ + (+)	wide, a little wide	± ~ + + + +	+ ~ + + +
½	± ~ + + +	± ~ + + +	supra-short rod, guitar form, short rod, rosary form	+ + ~ + + +	± ~ + + + +	a little wide, narrow	- ~ + + (+)	± ~ + +
1	- ~ + (+)	- ~ +	short rod, rosary form, guitar form	- ~ ±	± ~ +	a little wide	- ~ + + +	+ ~ + + +
2	- ~ + +	± ~ + (+)	short rod, rosary form, guitar form, long rod	± ~ +	± ~ +	a little wide, wide	- ~ + + +	+ ~ + + (+)
3	- ~ + +	± ~ +	long rod, short rod, guitar form, rosary form	± ~ + +	± ~ +	a little wide, (wide)	- ~ + + +	+ ~ + + (+)

III. Discussion.

For the sake of convenience, the representative results of *productin* vacuoles, peptic secretory granules and vacuoles are described in the same figure.

The results obtained from the rats injected with hydrocortisone 1mg/kg, 5mg/kg, 10mg/kg (Fig. 1, 2, 3) have many common points when compared with those of the normal rats (Fig. 4). Viz. 1. discharge of the gastric hormone *productin* following the administration of the diet is slight, 2. secretory granules in the peptic cells are generally few and 3. vacuolization of the peptic granules is slight. On the other hand, the secretory activity of the peptic cells obtained from the quantity of secretory granules and vacuoles, from the form of plastosomes in the cells seems to be different in each case and it does not coincide with the low discharge of *productin* which is almost similar in each case. The explanation of this inconsistency may be impossible by these experiments alone. The most obvious result obtained from these experiments is that the discharge of *productin* from the gastric surface cells is lowered as a result of the injection of hydrocortisone.

Fig. 3. Subcutaneous injection of 10 mg/kg hydrocortisone.

Fig. 4. Control. Administration of an artificial diet.

Results obtained from the rats injected with hydrocortisone for 5 days (Fig. 5, 6, 7) are different from those of the above experiments, and the effects are different according to the different doses of hydrocortisone. The only common result in these experiments is the low discharge of *productin*.

In the peptic cells, numerous granules can be seen after the diet and then vacuolization of them is caused 2—3 hrs. later in the case of 1 mg/kg injection. Considerable vacuolization of peptic granules can be seen 1—2 hrs. after the diet in the

Fig. 5. Subcutaneous injections of 1 mg/kg hydrocortisone for 5 days.

Fig. 6. Subcutaneous injections of 5 mg/kg hydrocortisone for 5 days.

Fig. 7. Subcutaneous injections of 10 mg/kg hydrocortisone for 5 days.

case of 5 mg/kg injection, and remarkable vacuolization can be observed after the diet in the case of 10 mg/kg injection. As it is obvious that the vacuoles in the peptic cells are due to the vacuolization of the peptic secretory granules and that the vacuolization is one of the functional steps of discharge, numerous vacuoles in the cells mean that numerous granules were previously produced in the cells and that the secretory activity of the cells progressed from production of the granules into discharge of same.

As a result of observations of the injection for 5 days, it is noticed that the secretory ability of the peptic cells differs according to the dose of hydrocortisone injected, viz. 1 mg/kg brings about such a function of the peptic cells as 'production > discharge' then 'production < discharge', 5 mg/kg brings about 'production = discharge' and 10 mg/kg brings about 'production $\leq$ discharge'. The reasons for these different activities are not known, but it is obvious that these must be due to the hydrocortisone in the respective doses.

From the results obtained in the case of the 10 day injections (Fig. 8, 9, 10), it is obvious that the more the dose of hydrocortisone increases the more the secretory activity of the peptic cells is lowered.

Here, the author compared the results of the injections for one time, five times and ten times of each dose. In case of 1 mg/kg hydrocortisone, inferior production

Fig. 8. Subcutaneous injections of 1 mg/kg hydrocortisone for 10 days.

Fig. 9. Subcutaneous injections of 5 mg/kg hydrocortisone for 10 days.

Fig. 10. Subcutaneous injections of 10 mg/kg hydrocortisone for 10 days.

of secretory granules can be noticed from the quantity of the granules in the peptic cells and from the form of plastosomes after the 1st injection; superior production and then belated vacuolization of the granules after the 5th injection; and a little more active production of the granules and active vacuolization of them after the 10th injection can be observed. In case of 5 mg/kg, a slightly inferior production of secretory granules and a slightly superior vacuolization of them after the 1st injection; superior production and vacuolization after the 5th injection; and inferior production and

vacuolization after the 10th injection can be observed. In case of 10 mg/kg, a considerably superior production of secretory granules after the 1st injection; remarkable vacuolization of the granules after the 5th injection; and the lowest secretory activity after the 10th injection can be noticed.

To sum up the observations as regards the effects of hydrocortisone, it can be stated that hydrocortisone controls in a remarkable manner the secretion of the gastric hormone *productin* and that it affects directly the secretory activity of the gastric peptic cells. However, the latter is not regular according to the dose of hydrocortisone and to the frequency of the injection. Viz. a small dose of it shows a trend to control production of the peptic secretory granules and to promote the vacuolization of them, a large dose of it shows a trend to inhibit the secretory ability of the peptic cells and an intervening dose shows sometimes a tendency to promote production of the granules and sometimes a tendency to promote the vacuolization of them.

As the above experiments were an injectional addition of the cortical hormone into normal rats, the author performed the extirpation of the suprarenal glands from normal rats so as to ensure the non presence of the cortical hormone. In these rats 24 hrs. after the operation (Table 10, Fig. 11), it is noticed that discharge of the gastric hormone *productin* and production of the peptic secretory granules after the diet are almost similar to those of normal rats, that the vacuolization of the

Fig. 11. The day after the total extirpation of the suprarenal glands.

peptic granules is lesser and that the form of plastosomes in the peptic cells is still more active even at a period of 3 hrs. after the diet. It seems as if a factor which promotes the vacuolization of the peptic granules is lacking. During 5 days after the operation, emaciation and death of the rats increase. From the surviving rats on the 6th day after the operation (Table 11, Fig. 12), a very inferior secretion of *productin* after the diet, a degeneration of the peptic cells and a dilatation of the gland lumen etc. are noticed. When, however, 10 mg/kg hydrocortisone is injected every day after the operation, the degenerative results are not obtained. The observations are, as shown in Table 12, Fig. 13, that discharge of *productin* is controlled slightly and that both production and vacuolization of secretory granules in the peptic cells are considerably active. Comparing these observations with those obtained from the

Fig. 12. 5 days after the total extirpation of the suprarenal glands.

Fig. 13. 10 mg/kg hydrocortisone was injected for 5 days after the total extirpation of the suprarenal glands.

rats 24 hrs. after the operation (Fig. 11), it is noticed that discharge of *productin* after the diet is lesser and that secretory vacuoles in the peptic cells are numerous. Here, the effects of hydrocortisone on the gastric surface cells and on the gastric peptic cells are plainly visible, viz. an inhibitory effect as regards the discharge of *productin* and a promotive trend as regards the vacuolization of the peptic secretory granules.

On the other hand, anthranilic acid which is said to have a similar effect to that of the cortical hormone was tested after the extirpation of the suprarenal glands (Table 13, Fig. 14). There can be observed some identical effects to hydrocortisone and some different effects from it on the gastric surface cells and on the peptic cells. The emaciation and the death of the rats are almost inhibited by the injection of anthranilic acid as well as by that of hydrocortisone.

From the results obtained by the author's experiment, it is obvious that the cortical hormone of the suprarenal glands can affect the secretory ability of the gastric peptic cells but its effects on it are not regular. The only regular and sure effect of the cortical hormone when it is injected into the animals is the inhibition of the discharge of the gastric hormone *productin* regardless of the dose injected. However, its effects on the gastric peptic cells differ according to the different dose injected

Fig. 14. 10 mg/kg anthranilic acid was injected for 5 days after the total extirpation of the suprarenal glands.

and regardless of the secretion of *productin*. A small dose of the hormone is less effective on the peptic cells, a large dose of it is remarkably inhibitive on the secretory ability of the peptic cells and a medium dose of it is sometimes promotive of production of secretory granules in the peptic cells and sometimes of vacuolization of the granules. The reason why the effects on the peptic cells are thus irregular will be explained as follows: Viz. the cortical hormone is not a direct stimulant of the secretory activity of the peptic cells but is effective on it by the balance with some other substance (hormone). It is assumed from the results obtained by the extirpation of the suprarenal glands that in general the effects of the cortical hormone on the peptic secretory activity are a tendency to promote the vacuolization of secretory granules in the peptic cells.

IV. Summary.

In order to study the effects of the cortical hormone of the suprarenal glands on the secretory activity of the gastric peptic cells, hydrocortisone 1 mg, 5mg, 10 mg per 1 kg of the animal's weight was injected subcutaneously 1 time, 5 times and 10 times and, on the other hand, hydrocortisone 10 mg/kg or anthranilic acid 10 mg/kg was injected for 5 days after the total extirpation of the suprarenal glands. The secretory activity of the gastric peptic cells in each experiment was compared and discussed with those obtained in case of normal animals. The results obtained can be summarized as follows.

1. It is obvious that the cortical hormone has some effect upon the secretory ability of the gastric peptic cells. The fact can be analyzed as in the following cases.

2. The regular and sure effect is to inhibit the discharge of the gastric hormone *productin* from the gastric surface cells, regardless of the dose injected. Accordingly, as a result of this effect, a small dose of the hormone seems to be inhibitory on the secretory activity of the peptic cells.

3. A large dose of the hormone inhibits the secretory activity of the peptic cells more remarkably than it inhibits the discharge of *productin*.

4. An intervening dose of the hormone has irregular effects in different cases, it sometimes actively promotes production of secretory granules in the peptic cells

and sometimes vacuolization of the granules. The reason for this, it is assumed that the cortical hormone is not a direct stimulant of the secretory activity of the peptic cells but effective on it by the balance with some other substance.

5. As a result of the extirpation of the suprarenal glands and of the injection of 10 mg/kg hydrocortisone or 10 mg/kg anthranilic acid for 5 days after the extirpation, it is noticed that a promotive effect on the vacuolization of the peptic secretory granules seems to be peculiar to the cortical hormone in addition to its regular and sure effect on *productin* secretion.

内 容 自 抄

副腎皮質ホルモンが胃腺主細胞分泌機能に及ぼす影響を検するためラット体重 1 kg につき 1 mg, 5 mg, 10 mg の割で hydrocortisone 1 回, 毎日 1 回 5 日間及び 10 日間皮下注射し, また他方副腎摘出及び摘出後 hydrocortisone 10 mg/kg, anthranilic acid 10 mg/kg 皮下注射等の実験を行い, 夫々の場合の給食による胃腺主細胞の分泌機能状態を正常ラットのそれと比較考察した. 得たる結果は以下の如く要約される.

1. Hydrocortisone が胃腺主細胞分泌機能に影響を及ぼすことは疑を容れない事実である. この事実は更に以下の通り分析される.

2. 常に認められる hydrocortisone の効果は胃粘膜表在細胞からの胃壁ホルモン *productin* 分泌を抑制することである. 従って少量の皮質ホルモンは *productin* 分泌抑制によって結果的には胃腺主細胞分泌顆粒新生にも抑制的に作用するが如くに見える.

3. 処が多量の hydrocortisone は *productin* 分泌抑制以上に胃腺主細胞分泌機能を全面的に強く抑制する.

4. その間の量では或時は主細胞分泌顆粒新生を促進する効果を示し, 或時は分泌顆粒の空胞化を促進する方向に作用する等一定しない. この事実は hydrocortisone が胃腺主細胞に直接作用するものでなく他のホルモンとの均衡関係に於て影響を現わすことに原因していると解せられる.

5. 副腎摘出例, 副腎摘出後 10 mg/kg hydrocortisone 注射例及び副腎摘出後 10 mg/kg anthranilic acid 注射例から得た結果では, 皮質ホルモンには明かな *productin* 分泌抑制作用の他に胃腺主細胞分泌顆粒の空胞化を促進する傾向が本来の効果として存するらしく推察されうる.

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