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Studies on the Effects of Amino-Acid on the Secretory Activity of the Gastric Peptic Cells and the Pancreatic Cells.

II. On the Effects of Amino-Acid in Diet.

アミノ酸が胃腺主細胞及び膵細胞の分泌機能に及ぼす影響について.

II. 食餌中のアミノ酸の効果.

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The author, in a former report, studied the effects of amino-acid solution or emulsion injected into the stomach on the secretory activity of the gastric peptic and the pancreatic cells, and found that the most effective amino-acid was Histidine, and the ones less effective than Histidine to be Methionine, Tyrosine and Tryptophane. The effects of the others almost negligible. These four amino-acids had the potency to get the gastric surface cells to discharge *productin* into the blood.

The reason why the author tested amino-acids was due to the findings of TOJYO viz. that the inhibited secretion of *productin* and the low secretory activity of the gastric peptic cells, resulting from a lack of protein in diet, were prevented by a micro-dose of Histidine in a non-protein diet. Therefore the author attempted to prove here, whether the above effective amino-acids were also effective when their micro-dose was given with the non-protein diet.

I. Materials and Methods.

Adult and male rats, weighting 100—120 g, accustomed to a regular feeding of Mc COLLUM's artificial diet were used. They were fed for 10 days with the artificial diet from which protein was removed and, instead of it, 5mg (daily per rat) each of Peptone, Methionine, Histidine, Tyrosine, Tryptophane or Histamine was given (Table 1)—described below as the Peptone-diet, the Methionine-diet, the Histidine-diet, etc. On the 11th day, samples were taken at periods 1. when rats were still unfed, 2. $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, and 3 hrs. after administration of diet.

Table 1. Description of the diet (per rat, daily) (g).

	Casein	Starch	Sugar	Cod-liver oil	Agaragar	McCollum's salt mixture	Vitamine B ₁	Water	Each of His- tidine, Me- thionine etc.
Mc COLLUM's artificial diet	1.47	6.08	1.0	1.0	0.2	0.2	0.05	10.0	
The experimental diet	0.0	7.55	1.0	1.0	0.2	0.2	0.05	10.0	0.005

To take samples, LUNA's liquid was injected into all arteries through the left heart ventricle for the vital-fixation under deep ether narcosis. Small pieces were taken from the glandular portion of the stomach and from the pancreas, and they were placed in KOLSTER's liquid for the post-fixation. Paraffin sections of 4μ were made and they were stained by HEIDENHAIN's iron haematoxylin. The gastric peptic cells, the surface cells of the gastric mucous membrane and the pancreatic cells were observed.

II. Observations.

In the gastric peptic cells, the quantity of secretion granules and of secretion vacuoles is described in the table with the form of plastosomes (pls.) and the aspect of the gland lumen. In the gastric surface cells, the quantity of *productin* vacuoles (FUJIE) in the cell, in the pancreatic cells, the quantity, the distribution and the size-irregularity of zymogen granules in the cell, the form of plastosomes and the aspect of the gland lumen are tabulated. These observations are described in the same manner as in former reports (Arch. hist. jap. 17, 1959).

A. The gastric peptic cells and the gastric surface cells. (Table 2—13)

Table 2. The Peptone-diet for 10 days. The peptic cells.

Hrs.	Total result			Representative result		Gland lumen
	Quantity of the intracellular secretory substance		Form of pls.			
	Granules	Vacuoles		Granules	Vacuoles	
Before	— ~ +	— ~ +	long rod, short rod	— ~ +	— ~ +	a little wide, narrow
$\frac{1}{2}$	$\pm \sim + +$	$\pm \sim + +$	short rod, guitar form, long rod, supra-short rod	$+ \sim + +$ $+ \sim + +$ $\pm \sim +$	$\pm \sim +$ $+ \sim + +$ $\pm$	a little wide, narrow
1	$\pm \sim + + +$	$\pm \sim + +$	short rod, supra-short rod, rosary form, guitar form	$+ \sim + + +$	$\pm \sim + (+)$	a little wide, (wide)
$1\frac{1}{2}$	$- \sim + + +$	$- \sim + +$	short rod, rosary form, guitar form, long rod	$+ \sim + +$	$\pm \sim + +$	a little wide, wide
2	$- \sim + +$	$\pm \sim + +$	short or long rod, guitar form	$+ \sim + (+)$	$\pm \sim + +$	a little wide, narrow
3	$- \sim + + +$	$\pm \sim + + +$	long rod, short rod, supra-short rod	$+ \sim + +$ $- \sim +$	$\pm \sim +$ $+ + \sim + + +$	a little wide, narrow

Table 3. The Peptone-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
Total result	+ ~ + + +	- ~ + +	- ~ + +	- ~ + +	$\pm$ ~ + + +	$\pm$ ~ + + +
Representative result	+ ~ + + +	- ~ + + (+)	$\pm$ ~ + +	$\pm$ ~ + +	+ ~ + + (<)	+ ~ + + +

Table 4. The Methionine-diet for 10 days. The peptic cells.

Hrs.	Total result			Representative result		Gland lumen
	Quantity of the intracellular secretory substance		Form of pls.			
	Granules	Vacuoles		Granules	Vacuoles	
Before	— ~ + +	± ~ +(+)	short rod, long rod, rosary form, supra-short rod, guitar form	± ~ +	± ~ +(+)	narrow, a little wide
$\frac{1}{2}$	— ~ +	— ~ +	short or long rod, rosary form, guitar form	± ~ +	— ~ +	a little wide, narrow
1	— ~ + + +	— ~ +	short or long rod, rosary form, guitar form, supra-short rod	± ~ +	— ~ +	a little wide, wide, narrow
$1\frac{1}{2}$	— ~ +	— ~ +	short rod, long rod, rosary form, guitar form	— ~ +	— ~ +	a little wide, narrow,
2	— ~ +	— ~ +	long rod, short rod, guitar form	±	± ~ +	narrow, a little wide
3	— ~ ±	— ~ +	long rod, short rod, rosary form	— ~ ±	± ~ +	narrow, a little wide

Table 5. The Methionine-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
Total result	- ~ + + +	- ~ + + (+)	- ~ + + (+)	- ~ + + +	$\pm$ ~ + + +	$\pm$ ~ + + +
Representative result	+ ~ + + +	+ ~ + +	+ ~ + +	+ ~ + + (+)	$\pm$ ~ + + +	$\pm$ ~ + + +

Table 6. The Histidine-diet for 10 days. The peptic cells.

Hrs.	Total result		Form of pls.	Representative result		Gland lumen
	Quantity of the intracellular secretory substance			Granules	Vacuoles	
	Granules	Vacuoles				
Before	— ~ + +	± ~ + +	short rod, long rod, rosary form	± ~ + +	± ~ + +	narrow, a little wide
½	± ~ + + +	± ~ + + +	short rod, guitar form, rosary form, long rod	+ ~ + + + ±	± ~ + + + + ~ + + +	wide, a little wide
1	± ~ + + +	± ~ + +	short rod, supra-short rod, guitar form, short or long rosary form	+ ~ + + +	± ~ +	wide, a little wide
1½	— ~ + +	± ~ + + (+)	supra-short rod, short rod, guitar form, (long rod)	— ~ + (+ ~ + +	+ ~ + + (+) ± ~ +)	a little wide
2	— ~ + +	± ~ + +	short rod, rosary form, long rod	— ~ +	± ~ + (+)	a little wide, narrow
3	— ~ + (+)	— ~ + +	long or short rod, rosary form	— ~ +	± ~ + (+)	a little wide, narrow

Table 7. The Histidine-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	½	1	1½	2	3
Total result	-~+++	-~+++	-~++(+)	-~+++	±~+++	±~+++
Representative result	±~+++	±~++	-~++	±~++	±~+++	+~+++

Table 8. The Tyrosine-diet for 10 days. The peptic cells.

Hrs.	Total result			Representative result		Gland lumen
	Quantity of the intracellular secretory substance		Form of pls.			
	Granules	Vacuoles		Granules	Vacuoles	
Before	— ~ +	± ~ + +	long rod, short rod, guitar form, rosary form	— ~ +	± ~ +	narrow, a little wide

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

Table 9. The Tyrosine-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
Total result	$\pm\sim++++$	$\pm\sim++++$	$\pm\sim++++$	$\pm\sim++++$	$\pm\sim++++$	$+\sim++++$
Representative result	$+\sim++++$	$\pm\sim++++$	$+\sim++++$	$\pm\sim++++$	$+\sim++++$	$+\sim++++$

Table 10. The Tryptophane-diet for 10 days. The peptic cells.

Hrs.	Total result		Form of pls.	Representative result		Gland lumen
	Quantity of the intracellular secretory substance			Granules	Vacuoles	
	Granules	Vacuoles				
Before	— ~ ±	± ~ +	short rod, long rod, rosary form, guitar form	±	+	narrow, a little wide
½	— ~ +	± ~ ++	long or short rod, guitar form, supra-short rod	± ~ +	+ ~ ++ (>)	a little wide, narrow, wide
1	— ~ ++	± ~ ++	short rod, long rod, guitar form, rosary form	— ~ ++	± ~ ++	a little wide, narrow
1½	— ~ +	± ~ ++	short or long rod, guitar form	±	+ ~ ++	a little wide, narrow
2	— ~ ±	± ~ ++	long rod, short rod, rosary form, guitar form	— ~ ±	± ~ ++	a little wide, wide
3	— ~ +	± ~ ++	long or short rod, guitar form	— ~ ±	± ~ +	a little wide

Table 11. The Tryptophane-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
Total result	$\pm \sim + + +$	$\pm \sim + + +$	$\pm \sim + + +$	$- \sim + + +$	$\pm \sim + + +$	$\pm \sim + + +$
Representative result	$+ \sim + + +$	$\pm \sim + + +$	$\pm \sim + + +$	$\pm \sim + + +$	$+ \sim + + +$	$+ \sim + + +$

Table 12. The Histamine-diet for 10 days. The peptic cells.

Hrs.	Total result			Representative result		Gland lumen
	Quantity of the intracellular secretory substance		Form of pls.			
	Granules	Vacuoles		Granules	Vacuoles	
Before	— ~ +	± ~ + +	long rod, short rod, long or short rosary form	— ~ +	+ ~ + +	a little wide, narrow
$\frac{1}{2}$	— ~ + +	± ~ +	short rod, guitar form, long rod	± ~ + + ~ + +	+ ± ~ (+)	a little wide, (narrow)
1	± ~ + +	± ~ + +	short rod, supra-short rod, guitar form, rosary form, long rod	+ ~ + +	± ~ + (+)	a little wide
$1\frac{1}{2}$	± ~ + + +	± ~ + + +	short rod, supra-short rod, guitar form, short rosary form	+ ~ + + (+)	+ ~ + +	a little wide, (wide)
2	± ~ + +	+ ~ + + +	short rod, rosary form, guitar form, supra-short rod, long rod	± ~ + +	+ +	a little wide
3	± ~ + +	± ~ + +	long or short rod, guitar form	± ~ + +	± ~ + +	a little wide, narrow

Table 13. The Histamine-diet for 10 days. The *productin* vacuoles in the gastric surface cells.

	Hrs.					
	Before	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
Total result	$\pm \sim + + +$	$- \sim + + +$	$- \sim + + +$	$- \sim + + +$	$+ \sim + + +$	$\pm \sim + + +$
Representative result	$\pm \sim + + +$	$\pm \sim + + +$	$+ \sim + + +$	$+ \sim + + +$	$+ (+) \sim + + +$	$+ \sim + + +$

B. The pancreatic cells. (Table 14—19)

In the pancreatic cells, various abnormal changes which may be a result of a lack of protein are observed frequently. These are 1. the vacuolization of zymogen granules, 2. the vacuoles surrounding the nucleus and 3. the abnormal form of plastosomes such as droplet shaped, gross granule shaped, comma shaped, ring formed, racket shaped or spindle shaped etc. These abnormal structure are identical with those which were previously described by FURUTA (Arch. hist. jap. 11, 1956). However these abnormalities seem to have less affect on the secretory activity of the pancreatic cells, the author has not described them in the tables.

Table 14. The Peptone-diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribution	Irregularity in size				
Before	+ ~ + + +	loose	little	short or long rod, guitar form	weakest weak	empty, straggling, (massive)	weak
$\frac{1}{2}$	+ ~ + + +	a little dense	a little	short rod, short rosary form, guitar form, long rod	weak middle	straggling, empty, (massive)	weak (middle)
1	$\pm \sim + (+)$		large	supra-short rod, short rod, guitar form, short or long rosary form	middle strong	straggling, massive, blackened, empty	middle strong
$1\frac{1}{2}$	+ ~ + + (+)		large	short rod, supra-short rod, guitar form, long rod, long rosary form	strong middle	straggling, massive, blackened, empty	middle strong
2	$\pm \sim + + +$	loose	a little large	short rod, supra-short rod, rosary form, guitar form, long rod	strong middle	straggling, massive, blackened, empty	middle strong
3	+ (+) ~ + + +	a little loose	large	short rod, guitar form, long rod, supra-short rod	middle (strong)	straggling, empty, massive	weak middle

Table 15. The Methionine diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribution	Irregularity in size				
Before	+ ~ + + +		a little	short rod, long rod, supra-short rod, rosary form	weak	empty, straggling	weakest weak
$\frac{1}{2}$	$\pm \sim + +$	a little loose	large	short rod, guitar form, rosary form, long rod	weak (middle)	empty, straggling, massive	weak middle
1	+ ~ + + +	loose	a little	short rod, long rod, guitar form, rosary form	weak	empty, straggling, (massive)	weak
$1\frac{1}{2}$	$\pm \sim + (+)$		a little	long rod, short rod, guitar form, supra-short rod, rosary form	weak	straggling, massive, blackened, empty	middle strong
2	- ~ + +		a little large	short or long rod, rosary form, guitar form	weak	straggling, empty, massive	weak middle
3	- ~ + (+)	loose		long or short rod, rosary form	weak weakest	empty, straggling	weakest weak

Table. 16. The Histidine-diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribution	Irregularity in size				
Before	+ ~ + + +		little	long rod, short rod	weakest weak	empty, straggling	weakest weak
$\frac{1}{2}$	$+ (+) \sim + + +$	dense	large	short rod, guitar form, long rod, supra-short rod, rosary form	(weak) middle	empty, straggling	weakest weak
1	+ ~ + + +		large	short rod, rosary form, guitar form, long rod	(weak) middle	straggling, empty, massive	middle
$1\frac{1}{2}$	$\pm \sim + + +$		a little	short rod, short rosary form, guitar form, supra-short rod, long rod	middle	straggling, empty, massive	middle

2	—~++		a little large	short rod, guitar form, rosary form, long rod	middle weak	straggling, massive, empty, blackened	middle (strong)
3	—~+(+)		little	short rod, long rod, rosary form, guitar form	weak	straggling, massive, empty	middle

Table 17. The Tyrosine-diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribu- tion	Irregulari- ty in size				
Before	±~++		a little	long rod, short rod, rosary form	weakest weak	empty, straggling	weakest weak
½	±~++		a little	short rod, guitar form, long rod	weak	empty, straggling	weakest weak
1	—~++		a little	short rod, long rod, guitar form	weak	straggling, empty, massive	weak middle
1½	—~++		little	long rod, rosary form, short rod	weak	empty, straggling	weak weakest
2	—~++		little	short rod, long rod, guitar form, rosary form	weak	empty, straggling, (massive)	weak
3	—~+(+)	loose	little	long rod, short rod	weakest	empty, straggling	weakest weak

Table 18. The Tryptophane-diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribu- tion	Irregulari- ty in size				
Before	±~+(+)			long or short rod	weakest	empty, straggling, massive	weak middle
½	+~+++		a little	short rod, long rod, supra-short rod, guitar form	weak (middle)	empty, straggling	weak weakest
1	±~++(+)		a little	long rod, short rod, rosary form	weak	empty, straggling, (massive)	weak
1½	—~++		a little	long rod, short rod, rosary form	weak	straggling, empty	weak

2	—~+(+)	a little dense	a little	long rod, short rod	weakest	straggling, empty, massive	weak middle
3	—~+		little	long rod. short rod	weakest	straggling, empty, massive	weak middle

Table 19. The Histamine-diet for 10 days. The pancreatic cells.

Hrs.	Zymogen granules			Form of pls.	Production to be considered	Gland lumen	Discharge to be considered
	Quantity	Distribu- tion	Irregulari- ty in size				
Before	+~+++	loose		long rod, short rod, rosary form	weak	empty, straggling	weakest weak
½	±~+++		a little	long rod, short rod, rosary form, guitar form	weak	empty, straggling, massive	weak middle
1	±~++	loose	a little	short rod, short rosary form, long rod, guitar form	middle	straggling, massive, empty, blackened	middle (strong)
1½	±~+++		large	short rod, guitar form, supra short rod, rosary form, long rod	middle (strong)	straggling, empty, massive	middle weak
2	+~+++	a little dense	a little	short rod, rosary form, long rod, guitar form	middle weak	straggling, empty, massive	middle weak
3	±~++(+)		a little	short rod, short rosary form, long rod, guitar form	weak	straggling, massive, empty	middle

III. Discussion.

For the sake of comparing the secretory activities of the gastric peptic cells with each other and of contrasting them with the previous results obtained by an injection into the stomach, the author described the average quantity of secretion granules and secretion vacuoles in the peptic cells and of *productin* vacuoles in the gastric surface cells in the same figure (Fig. 1—6).

In the case of the Peptone-diet (Table 2, 3; Fig. 1.), the secretory activity of the peptic cells is similar to that caused by the injection of 10% Peptone solution into the stomach. On the following two points, there are little differences, viz. 1) the secretion of *productin* vacuoles after administration of the Peptone-diet seems to be a little weak, 2) secretion vacuoles in the peptic cells are still numerous even at periods of 2—3 hrs. after the administration. These may be due to the

Fig. 1. The Peptone-diet for 10 days. ● Secretion granules in the peptic cells, ○ Secretion vacuoles in them, × *Productin* vacuoles in the surface cells.

lesser quantity of Peptone given with the non-protein diet than when its solution was injected into the stomach.

In the case of the Histidine-diet (Table 6, 7; Fig. 2), both discharge of *productin* vacuoles from the surface cells and production of secretion granules in the peptic cells are very active after the administration but they cease earlier than in

Fig. 2. The Histidine-diet for 10 days.

the case where 10% solution of Histidine was injected into the stomach. This may be due to the quantitative difference of Histidine given. In this case, it is noticed that secretion vacuoles in the peptic cells are numerous and that at periods of 1 1/2—3 hrs. after the administration they are identical with those obtained by administration of a normal artificial diet.

Fig. 3. The Histamine-diet for 10 days.

In the case of the Histamine-diet (Table 12, 13; Fig. 3), production of secretion granules in the peptic cells grows gradually after the administration, and it becomes as active as in the case where 10% solution was injected into the stomach. This may indicate that the absorption of Histamine from the wall of the stomach is delayed in this case.

On the other hand, in the case of the Methionine-diet (Table 4, 5; Fig. 4), and of the Tyrosine-diet (Table 8, 9; Fig. 5), and of the Tryptophane-diet (Table 10, 11; Fig. 6), the results are extremely different from those obtained when these amino-acids were injected into the stomach. In case of the Methionine-diet, the lowest

discharge of *productin* from the gastric surface cells and the lowest production of secretion granules in the peptic cells can be seen. In the case of Tyrosine-diet and the Tryptophane-diet, the low discharge of *productin* and the low production of peptic secretion granules and their relatively active vacuolization are observed. It follows from this result that a small discharge of *productin* from the surface cells, by which the effect of the decomposed product of the *productin* can be scarcely seen, will be presumed. The low secretion of *productin* in these cases is negligible when compared to that obtained by the injection of 10% solution or emulsion of these amino-acids into the stomach.

As is obvious, Methionine, Tyrosine and Tryptophane which were remarkably effective on the secretory activity of the gastric peptic cells when they were injected into the stomach, have no potency to promote the low secretory activity of the

Fig. 6. The Tryptophane-diet for 10 days.

peptic cells caused by a lack of protein in the diet. On the contrary, Histidine and Histamine which were most effective on the secretory activity of the peptic cells after injection into the stomach, have also an effective potency to promote the activity of the cells even if the diet was lacking in protein. As a result of these observations, it is still more probable that to initiate the secretory activity of the gastric peptic cells a substance containing an imidazol group is necessary.

In the pancreatic cells (Table 14—19), the most active secretory function can be seen in the case of the Peptone-diet. In other cases, discharge of zymogen granules is almost the same and is remarkably active. This will be due to the abundance of carbohydrates and the proper quantity of fats contained in the diet. Production of zymogen granules in the cells differs in each case. In the case of the Methionine-diet, of the Tyrosine-diet and of the Tryptophane-diet, it is almost negligible, but in the case of the Histidine-diet and of the Histamine-diet, it is very active. This fact may be the result of the very low secretion of *productin* in the former three cases, of the active discharge of *productin* in the Histidine-diet case and of the Histamine absorbed into the blood from the gastric wall in the Histamine-diet case, because the facts that the *productin* secreted into the blood promotes production of zymogen granules in the pancreatic cells and that an actional similarity between *productin* and histamine can be seen, have been previously demonstrated by FUJIE in his *productin*-theory. As is obvious here, the more the substance is effective in discharging *productin*, the more it promotes the production of zymogen granules in the pancreatic cells, and this is so regardless of administration with the diet or of direct injection into the stomach. Therefore, as regards production of zymogen granules in the pancreatic cells, the fact that humoral stimulation (viz. *productin*) is still more effective than nervous stimulation will be recognized here, as was claimed by FUJIE.

IV. Summary.

The author proved here, whether the inhibited secretory activity of the gastric peptic and the pancreatic cells caused by a lack of protein in the diet, can be prevented by the amino-acids which are effective in the promotion of the secretory activity of these cells when their solution or emulsion is injected into the stomach of normal rats. The results obtained are as follows.

1. The only amino-acid which can prevent the inhibited secretion of *productin* resulting from the feeding with non-protein diet and that can promote the secretory activity (especially production of secretion granules) in the peptic and the pancreatic cells is Histidine.

2. If Histamine is given with a non-protein diet, it does not discharge *productin* from the gastric surface cells but it sufficiently promotes the secretory activity (especially production of secretion granules) in the peptic and the pancreatic cells. This fact will indicate a similarity between *productin* and histamine.

3. As a result of these experiments, it can be demonstrated that the initiation of the secretory activity in the gastric peptic and the pancreatic cells requires a substance containing an imidazol group, such as Histidine or Histamine. Here, the fact proved by FUJIE that an imidazol group can be demonstrated histochemically in the subnuclear portion of the gastric surface cells where *productin* vacuoles are seen, will be of great importance.

内 容 自 抄.

無蛋白食でラッテを飼育すると胃腺主細胞及び膵細胞の分泌機能が甚だ減退する事実、その原因は胃腺主細胞や膵細胞自体の機能的退化にあるのではなく、胃粘膜表在細胞からの胃壁ホルモン *productin* 分泌の障害にあるという実験的証明、及び微量のヒスチジン投与がその障害を完全に防止しうる事実等に鑑み、著者は多くのアミノ酸の10%溶液又は浮遊液を胃内に注入して検した。ヒスチジンの他にもメチオニン、チロジン、トリプトファンが *productin* 分泌を促し胃腺主細胞や膵細胞の分泌機能を旺盛ならしめることを知った。依って著者はヒスチジン、ヒスタミン、メチオニン、チロジン、トリプトファンを夫々無蛋白食に添加し、胃内注入の時と同様の効果を示すか否かを此所に検した。得たる結果は次の如くである。

1. 無蛋白食飼育に由来する *productin* 分泌障害を防止し、胃腺主細胞及び膵細胞の分泌機能（殊に分泌顆粒新生）を促進するアミノ酸はヒスチジンのみで、メチオニン、チロジン、トリプトファンは殆ど無効である。

2. ヒスタミン投与は *productin* を放出させないが、胃腺主細胞、膵細胞の分泌機能（殊に分泌顆粒新生）を活潑ならしめる。此所に於ても *productin* とヒスタミンの相似性が認められる。

3. 上の結果から胃腺主細胞、膵細胞の分泌機能の営みと imidazol 核とは離すべからざる関係にあることが明らかである。こゝに於て *productin* 空胞の存在部位に imidazol 核を証明した藤江の組織化学的研究の結果は誠に意義深いことになる。

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