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A NEW TYPE OF NON-CILIATED CELLS, JUNCTURA CELLS, IN THE RAT OVIDUCT

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The non-ciliated cells found in the junctura portion of the rat oviducts were PAS-negative or faintly positive and often formed tubular glands in the epithelium. The cells were named "junctura cells (JC)" by the writer. The present study by hormone treatment suggests that the JC are a new type of non-ciliated cells whose secretory function becomes active after an estradiol treatment compared with the non-ciliated cells in the other segments of the rat oviduct. The JC and PAS-slightly positive cells in the segment V (JSC) behaved similarly after an estradiol or progesterone treatment. The JC may possibly be changed into the JSC. The histological findings were also ascertained by transmission and scanning electron microscopical observations.

INTRODUCTION

In the mammalian oviducts, two types of epithelial cells have been identified; ciliated and non-ciliated cells. The former are PAS-negative and the latter are PAS-positive secretory cells (BORELL et al., '59; DEANE, '52; NILSSON & REINIUS, '69). The writer distinguished non-ciliated cells of the rat oviduct into several types and he divided the oviduct into five segments according to the distribution of various types of cells in the rat (LEE et al., '76). At present, however, there seems to be no evidence whether or not the non-ciliated cells are only one type or more than one. The morphology of non-ciliated cells found in segment V clearly differed from that of the cells in the other segments. The cells were called "junctura cells" by the writer because segment V corresponded to the junctura. The behavior of the junctura cells after some hormone treatments will be described in this paper.

MATERIALS AND METHODS

Fifteen white Wistar normal cycling rats aged 3 to 5 months were used as materials; five rats were daily injected subcutaneously with 1 μ g of 17-estradiol (Sigma Chemical Co. Ltd) dissolved in 0.5 ml propylen glycol for ten days. Other five rats were simi-

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larly injected with 2.5 mg of progesterone (Nakarai Chemical Ltd). The rats showed to be estrus or metestrus when the hormonal injection was started. After 12 hours of injection, the vaginal smear from the former group showed prolonged estrus, and that of the latter metestrus for ten days. The remaining five were injected with 0.5 ml propylen glycol only as controls. This control group showed a normal sexual cycle by vaginal smears. The oviducts were sampled within 12 hours after the last injection, fixed in Zenker's fixative agent and embedded in paraffin. The sections were stained with hematoxylin-eosin, PAS, trichrome and alcian blue. Some pieces of the oviducts were fixed with 3% glutaraldehyde and 1% osmic acid, and embedded in epoxy resin. Thin sections were stained with uranyl acetate and lead citrate and observed under an HU-12A electron microscope. For scanning electron microscopy, the oviducts were quickly dissected from each rat and placed in a physiological saline solution. The oviducts were separated from the uterus and ovary and trimmed off fats and other extraneous tissues under a stereoscope. The oviducts were extended and cut into segments. Each segment was dissected free longitudinally with a razor. Mucin was removed by the method of DIRKSEN & SATIR ('72). The tissues were dehydrated in successive grades of ethanol. The ethanol was replaced with iso-amyl acetate, and the specimens were critical point dried (HCP-1 type) using carbon dioxide. They were subsequently coated with gold in the ion coater and were examined with an MSM-4T type scanning electron microscope operating at 10 to 15 kV in the secondary electron mode.

RESULTS AND DISCUSSION

The non-ciliated cells were classified into four types; out of these, three were PAS-slightly positive cells with short microvilli (SSC), PAS-strongly positive cells with long microvilli (LSC), and PAS-faintly positive or negative junctura cells with short microvilli and tubular glands (JC).

The fourth type was the SSC in the segment V (JSC). The JSC was clearly distinguished from the SSC in segments II and III corresponding to a part of the pre-ampulla and ampulla after the hormonal treatments as described below. During the normal sexual cycle, the SSC and the JSC are changed in shape, from columnar cells to apocrine cells (secretory form) or peg cells (degenerating form), but the cyclic changes of the four types of cells were not so clear, probably due to the shortness of the rat sexual cycle (4 days).

As shown in the table, following the hormonal treatment, the changes of the SSC were not so clearly different between the estradiol-treatment (E) and the progesterone-treatment (P). Some cells, however, were shaped like peg cells or apocrine cells after E or P, but the peg cells were presented by after P more than after E (fig. 1), that is, the SSC seemed to release a secretory substance after E and then to degenerate after

TABLE *Histological cellular changes after hormonal-treatments*

		SSC*	LSC*	JSC*	JC*	
Treatment	17 β -estradiol	Cell height (μ)	15~30	20~32.5	15~35	12.5~30
		PAS stainability \blacksquare	moderate	strong	moderate	faint
		Secretory granules	+	#	+~#	+
		Tubular glands	-	-	+	#
		Peg cells	-~ \pm	-	-	-
		Apocrine cells	+	-	+	-
Treatment	Progesterone	Cell height (μ)	15~35	15~30	15~25	10~20
		PAS stainability	faint	strong	faint	negative
		Secretory granules	+	#	-~+	-
		Tubular glands	-	-	-	-~+
		Peg cells	+	-	-	-
		Apocrine cells	-	-	-	-

- : absent, \pm : slight, + : moderate, # : numerous, ## : very numerous

* SSC, LSC, JSC, and JC : refer to the text for definitions

P. The LSC were strongly PAS-positive and numerous secretory granules were found at the apical part of the cells after both E and P. After P, however, the granules were more numerous than after E and were often located at the supranuclear part corresponding to the Golgi area (fig. 2). This finding showed that the formation of the secretory granules became active after P. The JC decreased in height and the formation of tubular glands was sparse after P (fig. 4). After E, on the other hand, the cells became higher, and deep tubular glands were found more frequently (fig. 3). The activity of the secretory function of the JC was quite different from the SSC and LSC after the hormonal treatments. The JSC behaved as the JC. Tubular glands were sometimes found after P.

Electron microscopy ascertained the above-described histology; after E the JC increased in height and contained a number of small, dark secretory granules in the apical part of the cells. There were numerous, dilated rough-surfaced endoplasmic reticulums in the cytoplasm (fig. 7). After P, however, the JC and their microvilli decreased in height and contained numerous lipid granules in the cytoplasm. No secretory granules and no dilated rough-surfaced endoplasmic reticulums were found in the apical part of the cells (fig. 5). Scanning electron microscopic observations also revealed that after E the JC had more irregular and long microvilli on the surface than after P (fig. 6).

The SSC and LSC have been reported as types of non-ciliated cells in the rat oviduct (BORELL et al., '59; NILSSON & REINIUS, '69; TANAKA, '72); however, no

report mentioning the JC has appeared up to now. Regarding the rat oviduct, GADDUM-ROSSE & BLANDAU ('76) reported that the epithelial cells in the end portion of the isthmus (the present writer's segment V) had short microvilli in comparison to those of the proximal portion under a scanning electron microscope. AUGUSTIN & MOSER ('55) pointed out that the activity of alkaline phosphatase was maximum in the distal portion of the isthmus, but low in the ampullar portion of the rat oviduct. It suggests that the non-ciliated cells of the junctura part are differ from those of the ampullar part.

The above-mentioned works may support the present finding that the JC is a separate type of non-ciliated cell different from the SSC and the LSC. The JC may possibly change into the JSC; however further studies are needed to substantiate this hypothesis.

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EXPLANATION OF PLATES

PLATE I

- Fig. 1 SSC after estradiol-treatment in segment III
A few peg and apocrine cells are shown.
PAS-Hematoxylin × 440
- Fig. 2 LSC after progesterone-treatment in segment IV
PAS-positive granules are seen in the apical part of LSC and
more in the supranuclear part corresponding to the Golgi area.
PAS-Hematoxylin × 440
- Fig. 3 JC after estradiol-treatment in segment V
JC becoming higher and forming deep tubular glands are shown.
JSC are also shown.
PAS-Hematoxylin × 440
- Fig. 4 JC after progesterone-treatment in segment V
JC becoming low in height and the sparsity of tubular glands
are shown.
PAS-Hematoxylin × 440
- Fig. 5 Electron micrograph of JC after progesterone-treatment
JC and their microvilli decrease in height and contain numerous
lipid droplets. No secretory granules and no dilated rough-
surfaced endoplasmic reticulum are found in the apical part of
the cells.
× 7,800

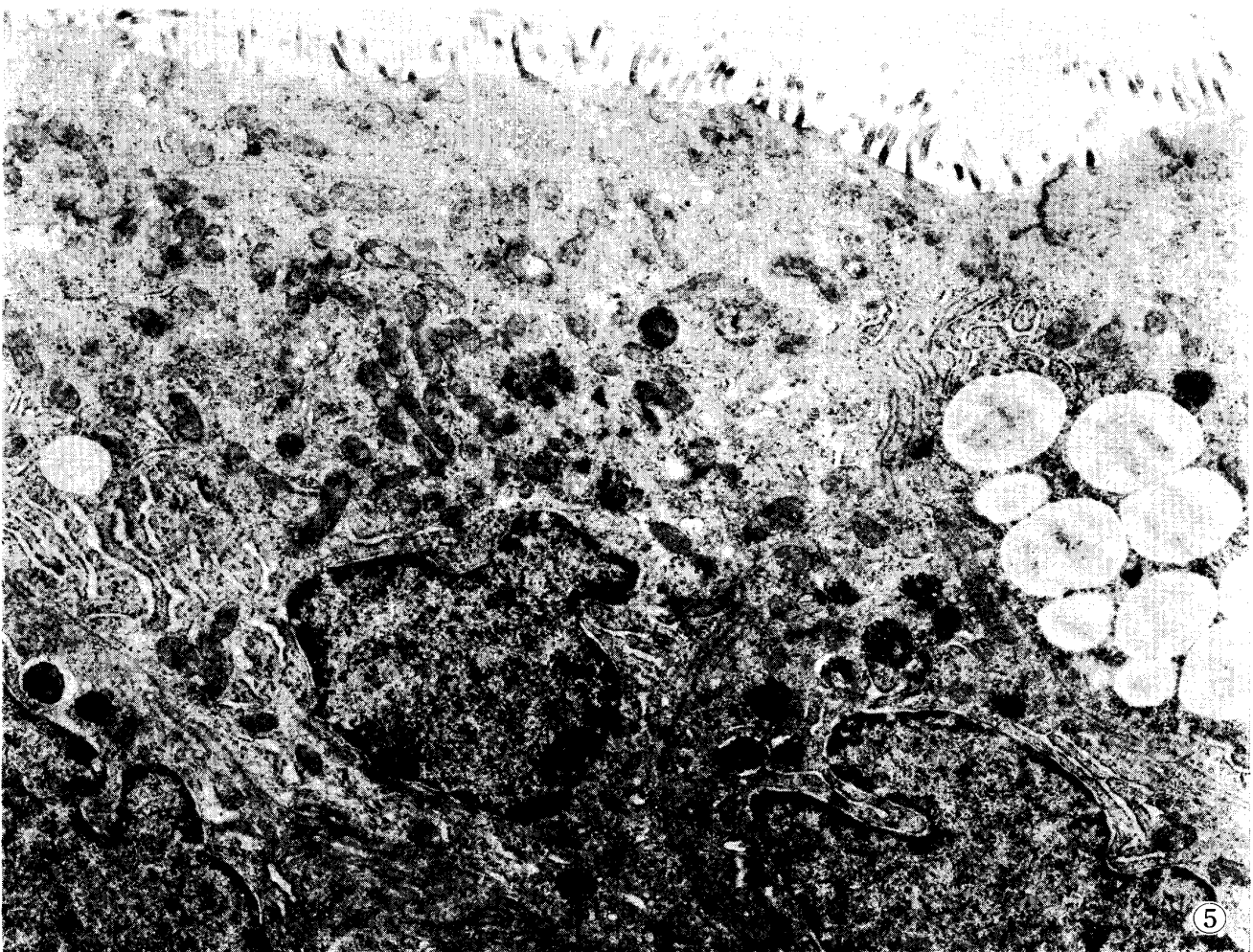
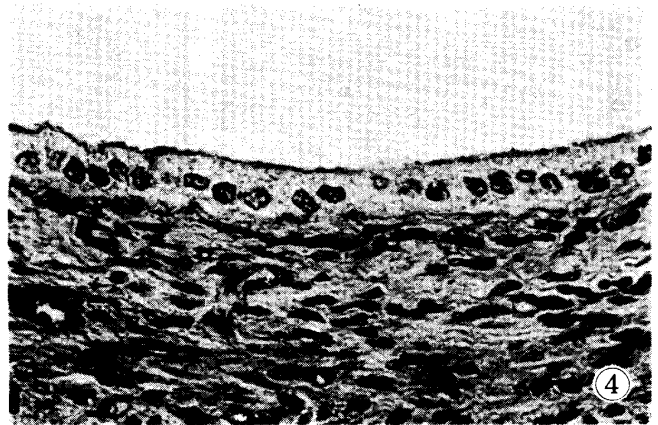
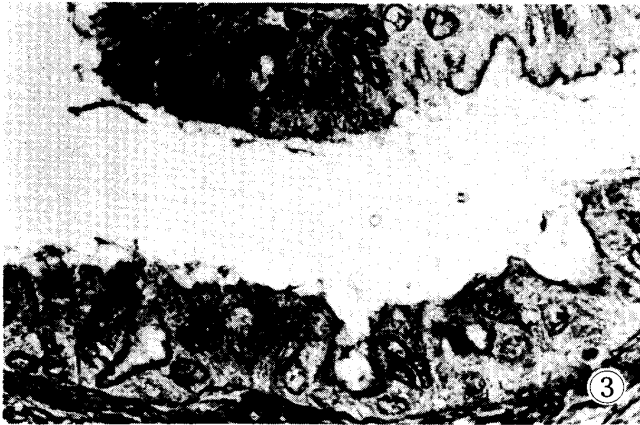
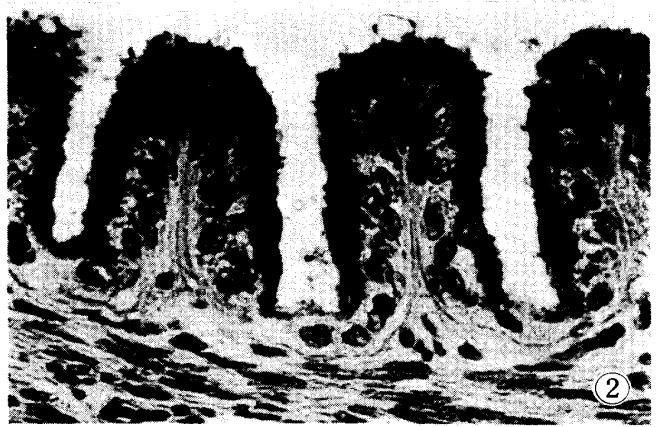
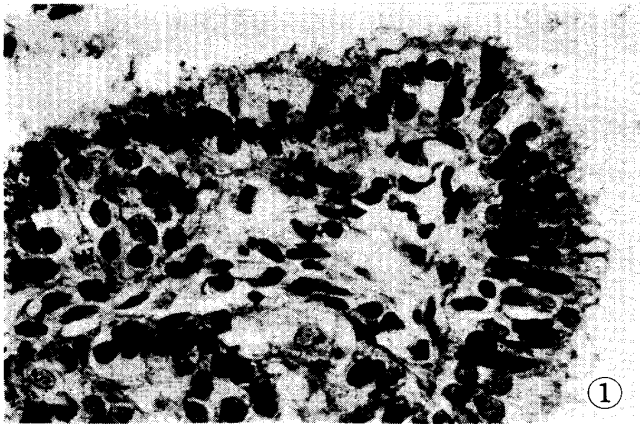


PLATE II

Fig. 6 Scanning electron micrograph of JC after estradiol-treatment
Note irregular and long microvilli on the surface of the JC.
× 11,250

Fig. 7 Electron micrograph of JC after estradiol-treatment
JC increase in height and contain a number of small dark secretory granules and dilated rough-surfaced endoplasmic reticulum.
× 7,800

