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Ultrastructural features of the Fallopian tube epithelium of bat, *Taphozous longimanus* (Hardwicke)

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KEYWORDS

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Abstract The epithelium of the Fallopian tube of *Taphozous longimanus* consists of two types of cells, ciliated and nonciliated secretory cells. The ciliated cells of tubal epithelium possess motile cilia (kinocilia) that emerge through the luminal membrane. The cytoplasm of the ciliated cells contains large lipid complex, abundance of polyribosomes, well developed Golgi apparatus, tubular ER and large number of mitochondria. The presence of fibrous granules, basal bodies, and ciliary buds indicates the process of ciliogenesis in the Fallopian tube. The nonciliated secretory cells of ampulla show balloon-like bulges which contain secretory granules. These cells were characterized by well developed rough endoplasmic reticulum, numerous polyribosomes and secretory granules of varied size, shape, and density. The secretory blebs were seen releasing into the lumen containing cell organelles. However, in some secretory blebs nucleus along with cell organelles were observed. The nonciliated secretory cells of isthmus show blunt cytoplasmic projection. Organelles such as mitochondria, Golgi apparatus, endoplasmic reticulum and secretory granules were seen in the cytoplasm. The presence of numerous mitochondria, a well developed Golgi apparatus and rough endoplasmic reticulum in both the ampulla and the isthmus indicates that tubal epithelium was responsible for the synthesis of protein secretion.

Introduction

The oviductal epithelium consists of two morphological distinct cell types, ciliated and nonciliated. The nonciliated cells synthesize and release secretory materials (Bjorkman and Fredricsson, 1960). Secretory products originating from the oviductal epithelial cells have been identified and characterized in several mammalian species (Abe, 1996). Some of these oviduct specific glycoproteins are associated with the zona pellucida of ova and or the surface of the spermatozoa and may play important roles in fertilization, early development and functions of spermatozoa (Hunter, 1994; King et al., 1994; Buhi et al., 2000; Abe et al., 1995b; Gandolfi, 1995; Killian, 2004; Bhatt et al., 2004). Thus, it is tempting to speculate that oviductal secretions create an important microenvironment for fertilization and early embryonic development.

Detailed electron microscopic studies on mammalian oviductal epithelial cells have been carried out by many workers (Bjorkman and Fredricsson, 1960; Nilsson and Reinius,

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1969; Odor et al., 1983; Abe and Oikawa, 1991; Abe, 1994; Abe et al., 1995). However, there is no report on the ultrastructural characteristic of tubal epithelium of bat. A previous study revealed that the oviductal epithelial cells of bat, *Taphozous longimanus* and *Taphozous melanopogon* secreted acid mucus glycoproteins (Sapkal and Gadegone, 1980; Gadegone et al., 2002). In spite of the importance of these findings available information on the secretory activity of epithelial cells of the bat oviduct is limited. The present study was undertaken to examine the ultrastructural features of ciliated and nonciliated secretory cells in ampulla and isthmus regions of the Fallopian tube of the bat, *T. longimanus* (Hardwicke) during estrus to clarify the relationship between morphological features and secretory activity.

Materials and methods

The emballonurid bat, *T. longimanus* (Hardwicke) was selected for the present study because of its unique reproductive habits. The specimens were collected from in and around Nagpur (MS), India. The specimens were brought to the laboratory alive. Mature females were separated from immature females after observing mammary glands and pelvic dugs. Seven sexually mature female bats in estrus were killed by cervical dislocation for present investigation.

For the electron-microscopic study, transverse segments of the ampullary and isthmic regions were obtained from these Fallopian tubes. Pieces of these segments were fixed in fresh ice-cold 3% glutaraldehyde for 3 h and then 4 h in 0.1 M cacodylate buffer. The tissues were washed in buffer and then post fixed for 1–2 h in 1% 0.067 M cacodylate-buffered osmium tetroxide. After dehydration with graded series of alcohol, the tissues were cleared in propylene oxide solution and embedded in Araldite resin which would be polymerized at 60° C. Then, ultrathin sections from selected blocks were cut with a glass knife and picked up on 400-mesh copper grids. Sections were double stained with 10% alcoholic uranyl acetate for 20 min and for 10 min in Reynold's lead citrate. The sections were examined under a JEM Jeol-100s electron microscope (Japan) at 80 KU accelerating voltage and photographed.

Results

The Fallopian tube of *T. longimanus* shows some morphological differences. In the ampulla the muscular coat was thin and mucosa forms numerous elaborate branched folds. In the isthmus the muscular coat was thick and the longitudinal folds were much shorter and less highly branched. The epithelium of the Fallopian tube during estrus consists of ciliated and nonciliated secretory columnar cells. These cells alternate irregularly in the epithelium. The apical portion of the nonciliated secretory cells bulges over the ciliated cells and forms protrusions or blebs which extend beyond the surface of the mucous membrane.

The epithelium of the ampulla consists of ciliated and nonciliated secretory cells. The ciliated cells of ampullary region were columnar, broader at the luminal surface and narrow at the base. They possess motile cilia (kinocilia) that emerge through the luminal membrane. The ciliated cells have interposed microvilli among the kinocilia (Fig. 1). Each cilium

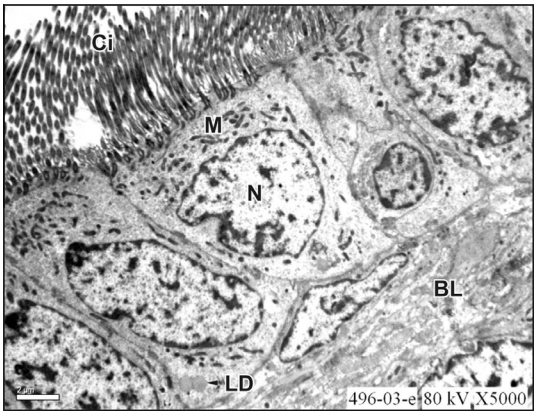

Figure 1 Electron micrograph of the ciliated epithelial cells showing a broad apex and narrow base. The ciliated cells show a large number of rod shaped mitochondria (M), elongated cilia (Ci) at apical end, indented nucleus (N) and lipid droplets (LD) at infranuclear cytoplasm. Basal cells are also seen (X 5000).

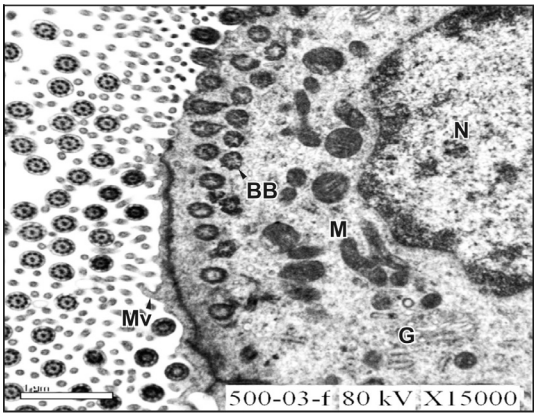

Figure 2 Electron micrograph of the ciliated cell showing a cross section through a group of cilia with 9 + 2 arrangement and cross section through a group of basal bodies (BB) with 9 peripheral triplet fibrils and no central fibrils. Mitochondria (M) and Golgi apparatus (G) are prominent. The cell surface has numerous microvilli (Mv) (X 15,000).

is a slender, hair like process that extends from the free surface of the cell. An extension of the cell membrane forms the ciliary membrane. Within the ciliary membrane is the axoneme a bundle of 11 fibrils consisting of 2 central single fibrils and 9 peripheral double fibrils. One of the subfibrils of each peripheral doublet has 2 short projections or arms. The fibrils were embedded in a matrix material which appears to contain fibers radiating out to the peripheral fibrils like spokes in a wheel.

The basal bodies are lined up in orderly rows immediately beneath the cell membranes. Each basal body was a hollow, cylindrical structure. Embedded within the wall of the basal body are 9 sets of triplet. Each triplet sets off an angle to the axis of the basal body so that the cross sectional appearance resembles a pinwheel. Fibrous rootlets with periodic cross-striation extend downward into the cytoplasm from the proximal end of each basal body (Fig. 2).