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ULTRASTRUCTURE OF THE EMBRYONIC AND ADULT AGLOMERULAR NEPHRON OF THE PIPEFISH, HALICAMPODES MACRORHYNCHUS (BAMBER)

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ABSTRACT

The epithelium of the adult mesonephric duct is more or less similar to that of the embryonic pronephric duct; both have few apical microvilli and non basal infoldings in their plasma membranes. They are considered of the same type and have the same function, thus termed the archinephric ducts. The most prominent features of the embryonic pronephric duct epithelium are the presence of RER, SER and large sized mitochondria with poorly developed cristae and slightly electron-dense matrix. The pronephric ducts perform their excretory function even while the embryos are still inside the brood pouches of males. The epithelium of the mesonephric duct is characterized by the presence of several autophagic vacuoles containing amorphus electron-dense material, a number of secretory vacuoles, more abundant small mitochondria with more electron dense matrix and SER. Secretion of salts, elimination of waste products, phagocytosis of foreign substances and water reabsorption are possibly performed

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by this type of epithelium.

The appearance of numerous microvilli, vacuoles, mono- and multivesicular bodies, various sized secretory vacuoles, well developed Golgi complex and many polyribosomal clusters in the epithelial cells of the aglomerular mesonephric tubules of unisegmental type proves its function in salt secretion. The existence of deeply extended basal infoldings, large numbers of mitochondria, extensive SER and vesicles in the basal region of the same cell indicates its important role in water reabsorption.

INTRODUCTION

The development of aglomerular kidneys of marine teleosts has been studied by Ogawa (1961) and Arru (1967) while that of the glomerular ones has been described by Holstvoogd (1954), Ford and Newstead (1958), Bielek (1974) and Khalil and Agamy (1981 and 1982).

Information on the fine structure of the cells of the aglomerular renal tubule of teleosts is available from the investigations of Bulger (1965) on Opsanus tau, Olsen and Ericsson (1968) on Nerophis ophidion and Ericsson and Olsen (1970) on Lophius piscatorius. However, the ultrastructure of the embryonic pronephric or adult mesonephric duct epithelia has not, so far, been studied in either aglomerular or glomerular teleostean kidneys.

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The present study is concerned with the ultrastructure of the aglomerular mesonephric tubule cells of unisegmental type in the pipefish, Halicampodes macrorhynchus (Bamber). It is hoped that the study will throw some light on the structure of the archinephric duct in the embryonic and adult stages.

MATERIAL AND METHODS

The pipefish, Halicampodes macrorhynchus (Bamber) were caught from the Red Sea, Hurghada.

The kidney of 8 mm long embryos from inside the brood pouch of male and that of adults of 150 mm standard length, were selected for the present E.M. investigation. The trunk region of the embryo and the kidney of the adult were excised and slices 1 mm thick were immediately fixed in cold 4% phosphate-buffered glutaraldehyde (pH= 7.4) for 3h., rinsed in the phosphate-buffer and fixed in 0.2% osmium tetroxide for 3h. (Palade, 1952). The specimens were then dehydrated in up graded series of ethyl alcohol followed by two changes of polymerized propylene oxide for 48 h. Ultrathin sections were cut and mounted on copper grids. The sections were stained with uranyl acetate and lead citrate (Reimer, 1967). The epithelial cells of the ducts and tubules were examined with electron microscope and electron micrographs were taken to illustrate the text.

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RESULTS

A) Ultrastructure of the embryonic pronephric duct epithelium .

The pronephric duct of the embryo is lined with high cuboidal epithelium conaining large round nuclei.

The apical surfaces of the cells are provided with few long microvilli and cilia. The apical plasmalemma and the microvilli possess a dense electron opacity. Fig. 3 shows the 9 + 2 microtubules of a cilium transversely cut in the lumen of the pronephric duct. Mono- and multivesicular bodies, small cytoplasmic vesicles, vacuoles and microtubules were encountered in the cytoplasm of the apical portion of the cell (Fig. 2).

The lateral walls possess no folds and the adjacent cells are supported with desmosomes (Fig. 1); in some cases, two desmosomes with their microfilaments are distinguished (Fig. 3).

The basal plasmalemma displayed no basal infoldings (Fig. 4). Many cytoplasmic membranes, vesicles and empty vacuoles are detected in the basal part of the cell (Fig.4).

Several large-sized mitochondria are scattered in the ground cytoplasm. In many cells, the mitochondria closely surround the nucleus; they appear round, elongate

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or irrigular in shape and exhibit marked size variation (Figs 1 and 3). The mitochondria show few tubular long cristae, clear internal matrix and few granules (Fig. 1 and Fig. 3); the cristae appear as folds in the inner mitochondrial membrane (Fig. 3). Two types of endoplasmic reticulum are encountered; the rough (RER) which is present in the apical region of the cell and contains numerous ribosomes, and the smooth (SER) which is present in the basal region (Figs 2 and 4). Profiles of ER occur either as flattened tubules or vacuoles. Free ribosomos of variable sizes, in the form of polyribosomal clusters, are scattered in the whole cell (Figs 3 and 4). The Golgi complex is located near the nucleus (Fig. 1); it consists of membrane- bound cisternae arranged in parallel array with associated small vesicles limited by smooth membrenes.

The nucleus is rounded and centrally or apically located (Figs 1 and 3); it is surrounded by a double nuclear membrane enclosing a narrow perinuclear space and possesses a single nucleolus. The nuclear membrane is interrupted by nuclear pores (Fig. 2). The chromatin appears as irregular clumps of deeply stained material distributed along the nuclear membrane and scattered throughout the nucleoplasm (Fig. 1).

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B) Ultrastructure of the adult mesonephric duct epithelium:

The epithelial cells lining the mesonephric duct are more or less cuboidal or low cuboidal, with centrally located nuclei.

The free surfaces of the cells send few, but more elongate parallel microvilli (Fig. 5), but cilia are absent. Several mono- and multivesicular bodies, empty vacuoles, vesicles and microtubules are most common in the apical regions of the cells (Figs 5 and 6).

The plasmalemmae of adjacent cells interdigitate with each other at their apical portions. Two types of lateral cellular junctions; gap and tight junctions, are also observed between each two adjacent cells (Fig. 7). Desmosome junctions as those present in the pronephric duct epithelium are absent. No basal infoldings are encountered in the basal plasmalemmae of the mesonephric duct cells.

The ground cytoplasm contains numerous large membrane-bound autophagic vacuoles. Such vacuoles represent the most prominent feature of the epithelium of the adult mesonephric duct and appear to be phagocytic function since they contain a variable amount of amorphus electron-dense material (mono- and multivesicular bodies, vacuoles, membranes and

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granules (Figs 6 and 7). In some cells, two autophagic vacuoles may connect with each other to form a single large vacuole (Fig. 6). Secretory vacuoles, containing numerous secretory granules, are also encountered in the ground cytoplasm (Figs 5,6 and 7). Mitochondria of various shapes and sizes are more abundant and possess smaller diameters, tubular cristae, amorphous matrix and more electron-dense material; sometimes they display a branched prophile (Fig. 7). In some cells, they are concentrated basally. Smooth endoplasmic reticulum is scattered throughout the whole cell; it has wavy flattened tubules lying parallel (Fig. 7) or horizontal (Fig. 8), to the axis of the cell. The Golgi apparatus consists of irregularly arranged cisternae and loosely arranged vesicles of various sizes.

The nucleus is elongated and central in position; the nuclear membranes are clear and possess numerous nuclear pores (Figs 5 and 8). Vesicular protrusions of the outer nuclear membrane are observed. Chromatin is distinguished as irregular clumps of deeply stained material distributed along the nuclear membrane and throughout the whole nucleoplasm (Figs 5 and 8). The nucleus contains more than one nucleolus (Fig. 5).

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C) Ultrastructure of the adult mesonephric tubule epithelium:

The mesonephric tubule is lined with high cuboidal cells surrounding a relatively small lumen in which many secretory materials and other waste products are present. Some cells have pyramidal shape with narrow free surfaces while some others possess wide free surfaces (Fig. 9). The cells of the two configurations are attached by desmosomes (Figs 10 and 11). The epithelium of the mesonephric tubule is surrounded by a thick fibrous basement lamina. Endothelial cells of the blood capillaries are found around the basal lamina; they possess fenestrations or fine diaphragmata (Fig. 9).

The free surface of the cell is characterized by the presence of a brush border consisting of long, narrow irregularly arranged microvilli and short projections (Fig. 9). Some microvilli are attached to each other by cytoplasmic bridges forming a branched structure (Fig. 10), while others are swollen at their distal portions due to the existence of vacuoles and cytoplasmic inclusions (Fig. 11). Few cilia of 9 + 2 arranged microtubules are randomly distributed in the apical part of the cell (Fig. 9).

The ground cytoplasm contains several spherical or oval smooth-surfaced vasicles and vacuoles with membranes

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more or less similar to those of the epical plasmalemmae. Large numbers of mono- and multivesicular bodies containing different electron-dense material, secretory vacuoles of various sizes and singly distributed microtubules are encountered in the ground cytoplasm (Fig. 11).

The lateral walls contain desmosomes and tight junctions. Bundles of microfilaments were observed radiating from the desmosomes. Neither lateral interdigitations nor gap junctions have been detected in the lateral walls of the adjacent cells.

Mitochondria of various shapes and sizes are found consistently in the ground cytoplasm; however, they are more evident in the apical region of the cell than in the basal region. The mitochondria in the middle region have spherical or oblique profiles; they contain tubular cristae and electron-dense granular matrix (Figs 9 and 12). The SER is distributed near the basal plasmalemmae, mitochondria and in the region of the nucleus. It consists of tubules and vacuoles of various sizes. On the other hand, the RER is rarely encountered in the mesonephric tubule epithelium, in spite of the presence of several ribosomes in the form of clusters scattered in the whole cytoplasm (Figs 11 and 12). The well-developed Golgi complex is located in supra- or latero-nuclear positions (Figs 9,10 and 12). It consists of several membrane-bounded saccules and vesicles.

The basal plasmalemma is provided with numerous and extensive basal infoldings (Figs 9 and 13) that extend deeply in the cytoplasm of some cells (Fig. 13). In cells in which the nuclei are basally located, they are short and never exceed the base of the nucleus (Fig. 9); in other cells, they are few and irregularly distributed. Large numbers of oval or elongated mitochondria are present between the basal infoldings in the basal region of the cell (Figs 9 and 13). Some vesicles are attached to, or in the vicinity of, the infoldings in the basal region of the cell. The vesicles are probably separated either from the tubules of the SER or from the membranes of the basal infoldings (Fig. 13).

The nuclei are irregular in outline, round or oval in shape and central (Fig. 9) or apical (Fig. 10) in position. Each is surrounded with a double nuclear membrane with nuclear pores. The chromatin is generally evenly distributed throughout the nucleoplasm.

DISCUSSION

The studies of Holstvoogd (1954), Ford and Newstead (1958),Ogawa (1961), Bielek (1974) and Khalil and Agamy (1981 and 1982) on the development of the kidney of some fishs showed that the pronephric and mesonephric ducts are

of the same origin and location. The present investigation reveals also the same fine structures of both ducts which are thus named the archinephric ducts. The epithelia of these ducts possess few apical microvilli and non basal infoldings. The existence of numerous RER, many free ribosome granules in the form of polyribosomal clusters, a well developed Golgi complex, several large mitochondria and large amounts of vesicles, mono- and multivesicular bodies in the epithelial cells of the embryonic pronephric duct supports their secretory function. This is consistent with the suggestion of Mollendorff (1936), and Ogawa (1958) who reported an apocrine secretion in both the pronephric and mesonephric ducts of Hippocampus, Cychthone and Petrophrine respectively.

The pronephric duct is referred to, in the embryological works, as the mesonephric duct as soon as the mesonephric tubules develop and connect with the pronephric duct. Due to the variation in function of the cells of the mesonephric duct in the adult fish compared to that in the embryonic stage, these cells show some variation in their ultrastructure. The most prominent features of the adult mesonephric duct cells are the presence of many autophagic vacuoles, large amounts of small mitochondria and absence of RER. The autophagic vacuoles are described

for the first time in the present species. Similar vacuoles have not been, so far, reported in the aglomerular nephronic epithelia of teleosts. The significance of the vacuoles is unknown but it is highly probable that the cells of the mesonephric duct play a role in the elaboration of waste products and phagocytosis of foreign materials. The presence of several secretory vacuoles, containing large amount of secretory granules, in the ground cytoplasm supports the secretory function of the mesonephric duct.

The basal regions of the epithelial cells contain well developed SER and large amounts of mitochondria with many cristae and great electron-density matrix. These fine structures may possibly be concerned with the activity of the cells in the reabsorption of some water.

Extensive research has been carried out on the urinary apparatus of marine and freshwater teleosts by Browne et al. (1950), Forster and Berglund (1956), Ogawa (1957), Bulger and Trump (1965), Jespersen (1967), Longely (1969), Oppermann (1973), Hackert-Korde (1977), and Hentschel and Meyer (1979). They confirmed that the aglomerular nephron of marine teleosts has a unisegmental structure where it consists throughout its entire length of one-cell type similar to the second portion of the proximal convoluted tubule of the glomerular nephron of the freshwater ones. The distal convoluted tubule

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is obviously of minor significance in the kidney function of marine teleosts, being either rudimentary, reduced or completely absent in several marine groups. From the Physiological point of view, the blood and body fluids of marine teleosts are hypotonic. Therefore, the function of the aglomerular nephron in such fishes is the secretion of large amounts of salts in the urine and the reabsorption of most water, so that they excrete small amounts of more concentrated urine. Black (1957), Conte (1969), Maunbach (1973), Ottosen (1978) and Hentschel and Meyer (1982) claimed that the secretion of bivalent ions is assumed to be one of the main functions for ion regulation of the second portion of the proximal convoluted tubule of marine teleosts since these secretory processes are very important for urine formation in the aglomerular species.

The present study confirms these results since each cell of the aglomerular mesonephric tubule epithelium of Halicampodes macrorhynchus can perform the secretion and reabsorption functions of the excretion process. The true brush border, consisting of densely-arranged microvilli, as described by Bulger (1965), Olsen and Ericsson (1968) and Ericsson and Olsen (1970) in some aglomerular nephronic cells, has not been observed in those of Halicampodes macrorhynchus during the present investigation. The microvilli are numerous and irregularly distributed and, sometimes,

connected with each other by cytoplasmic bridges (branched microvilli). Apocrine type of secretion is observed in the swollen microvilli and in the lumen of the tubule. This is in agreement with the observations of Mollendorff (1936) and Ogawa (1958). The apical vesicles which occur in great numbers in the cells of Halicampodes macrorhynchus, as well as in those of Nerophis ophidion (Olsen and Ericsson 1968), were found to be few in number in Lophius piscatorius (Ericsson and Olsen 1970). This suggests that the true aglomerular Syngnathiform fish, such as the first two species, are characterized by numerous apical vesicles than other aglomerular teleosts. The presence of vesicles, vacuoles, mono- and multivesicular bodies, secretory vacuoles and a well-developed Golgi complex in the nephronic cells of the present species is important evidence for its function in salt secretion. Bulger (1965), Olsen (1966), Olsen and Ericsson (1968), Linss (1969), Hentschel (1978) and Ottosen (1978) described remarkable populations of large mitochondria associated with basal-lateral infoldings of the epithelial cells in the second portion of the proximal convoluted tubule of marine glomerular and aglomerular teleosts. These morphological results are in line with the present findings and are, in general, confirmed by the histochemical studies of Hentschel and Meyer (1982) who reported activities of mitochondria-bound enzymes in the nephronic cells of many marine fish. In Lophius piscatorius, Olsen (1966) and Ericsson and Olsen (1970) recorded

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few mitochondria in the middle part of the cell. However, in Halicampodes macrorhynchus they are consistently present throughout the whole cell of the mesonephric tubule. Both observations may point out the rule of mitochondria in energy consuming ion reabsorbing processes.

The mesonephric tubule cell are characterized by the presence of several basal infoldings which originate from the basal plasmalemma and invaginate deeply in the cytoplasm together with longitudinally arranged large mitochondria in the basal region of the cell. These infoldings have been recognized in both glomerular nephron (Bulger and Trump 1965) and aglomerular ones (Olsen 1966), but have never been observed in the cells of the pronephric and mesonephric ducts of the species under investigation. Considerable variations occur in the basal regions of the cells of aglomerular nephron. In Opsanus tau, Bulger (1965) showed that numerous basal infoldings and mitochondria are present. In Lophius piscatorius, Olsen (1966) and Ericsson and Olsen (1970) recorded parallel or oblique arrangements of basal infoldings but without mitochondria between these infoldings. However, in Nerophis ophidion, Olsen and Ericsson (1968) regarded these infoldings in some cells as similar to those of Opsanus tau, while in other cells they are similar to those of Lophius piscatorius but with numerous mitochondria in the basal region

of the cells. They may possibly be concerned with salt secretion activity and / or elimination of water from the urine in marine teleosts. This supports the suggestion of Bulger (1965), that the basal infoldings have no definite function in either secretion or reabsorption processes. This view seems in some degree to interpret the absence of these infoldings from the epithelia of both pronephric and mesonephric ducts, and their predomination in that of the mesonephric tubule.

The junctional complex between the adjacent cells in various epithelia has been recorded by Farquhar and Palade (1963), Linss (1969) and Silverblatt and Bulger (1970). The existence of more than one desmosomal junction in the epithelium of the embryonic pronephric duct in the present study has been also reported by Ericsson and Olsen (1970) in Lophius piscatorius. It was found that, desmosomes predominate in the cells of the mesonephric tubule, while gap and tight junctions as well as interdigitation of the apical portions of cells are the most common in those of the mesonephric duct. The absence of lateral infoldings of the lateral plasmalemma seems to be characteristic for the epithelium of the renal tubules and ducts of the aglomerular teleosts (Bulger 1965, Olsen and Ericsson 1968), with the exception of Lophius piscatorius (Ericsson and Olsen 1970).

ABBREVIATIONS

AV = autophagic vacuoles, BF = basal infoldings, BL = basal plasmalemma, BM = basal lamina, CH = chromatin, CL = cilium, D = desmosome, DJ = interdigitations, EN = endothelium of blood capillary, GA = Golgi complex, GJ = gap junction, L = Lumen, MT = mitochondria, MV = micrvilli, N = nucleus, NM = nuclear membrane, NU = nucleolus, OV = monovesicular bodies, RER = rough endoplasmic reticulum. RS = ribosome granules, SER = smooth endoplasmic reticulum, SV = secretory vacuoles, TB = microtubules, TJ = tight junction, UV = multivesicular bodies, VA = vacuoles, VS = vesicles.

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** Figures 1-4 represent the epithelial cells of the embryonic pronephric duct of 8 mm long embryo of Halicampodes microrhynchus (Bamber).

Fig. 1: An electron micrograph showing two cells of the pronephric duct epithelium with desmosomes, few scattered microvilli, rough and smooth endoplasmic reticulum and round and elongated mitochondria. Notice the Golgi complex near the nucleus consisting of parallel cisternae, many vesicles and vacuoles. (X 20 000)

Fig. 2: An electron micrograph of the apical region of a cell showing microtubules, microvilli, mono- and multivesicular bodies together with vesicles, empty vacuoles and rough and smooth endoplasmic reticulum. Notice the double nuclear membrane with many pores. (X 36 000)

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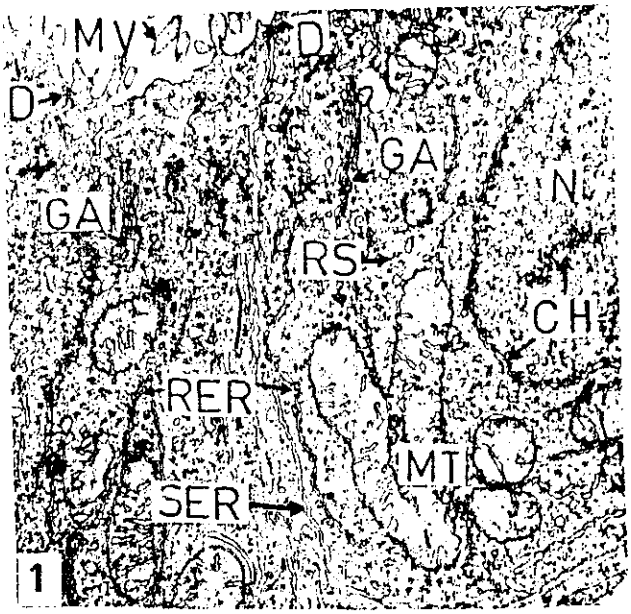

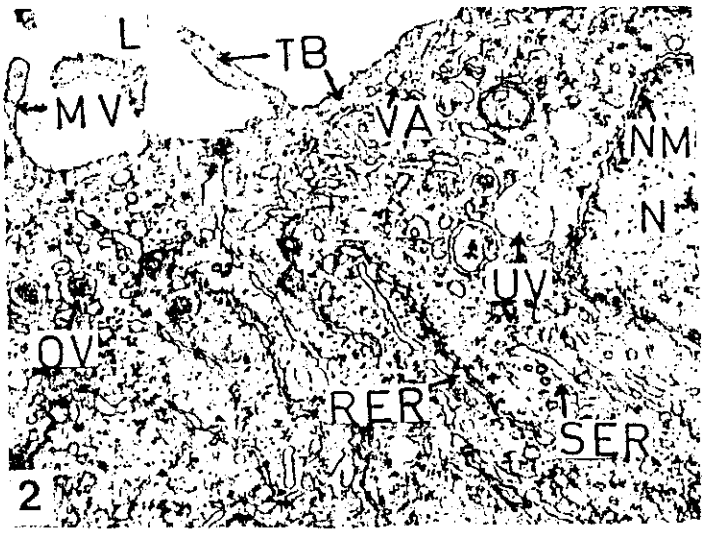

Fig. 3:An electron micrograph of a cell containing two desmosomes with radiating microfilaments, mitochondria with few cristae and slight electron-dense matrix, rough endoplasmic reticulum and free ribosome granules. Notice the cilium in the lumen of the duct. (X 30 000)

Fig. 4: An electron micrograph of the basal region of two cells containing ribosomes. much smooth endoplasmic reticulum, vacuoles, tubules and large mitochondria.

(X 44 000)

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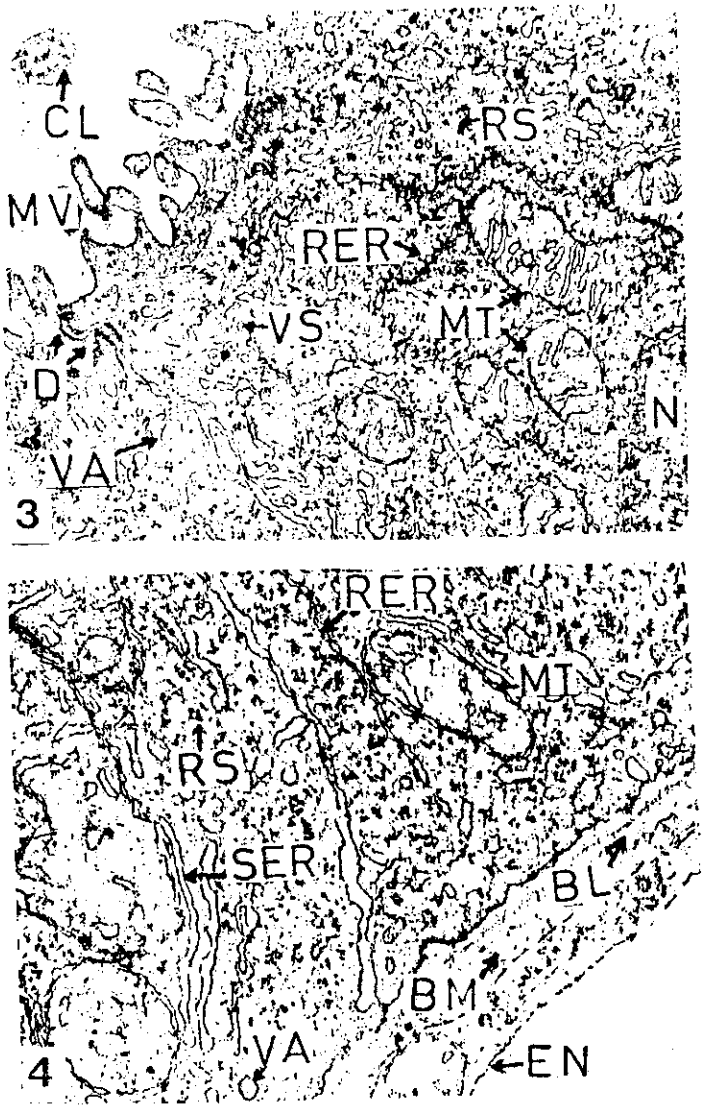

** Figures 5-8 represent the epithelial cells of the mesonephric duct of 150 mm long adult Halicampodes microrhynchus (Bamber).

Fig. 5: An electron micrograph of the apical region of a cell showing numerous vesicles, mono- and multivesicular bodies, vacuoles, microtubules and seretory vacuoles. The nucleus contains more than one nucleolus and electron-dense chromatin. Notice the double nuclear membranes enclose a narrow perinuclear space.

Fig. 6: An electron micrograph of the middle region of a cell showing several large autophagic vacuoles, each containing membranes, granules, large vesicles, vacuoles, mono- and multivesicular bodies. Notice the numerous small irregularly shaped mitochondria which contain many cristae and abundant mitochondrial matrix. (X 24 000)

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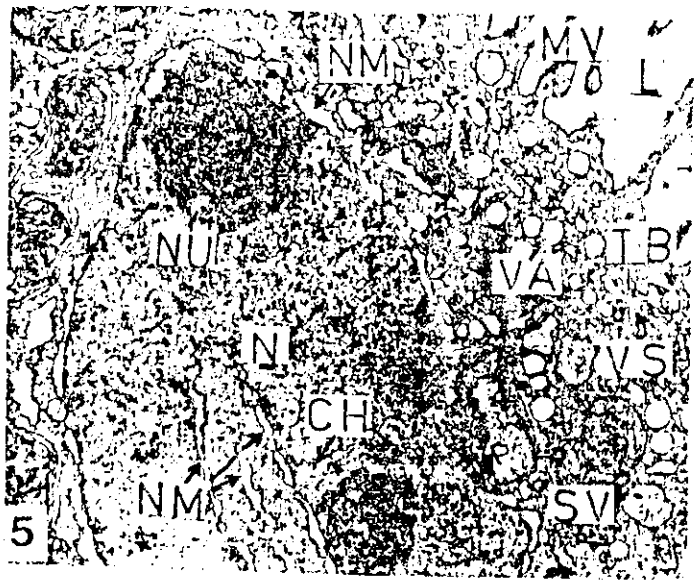

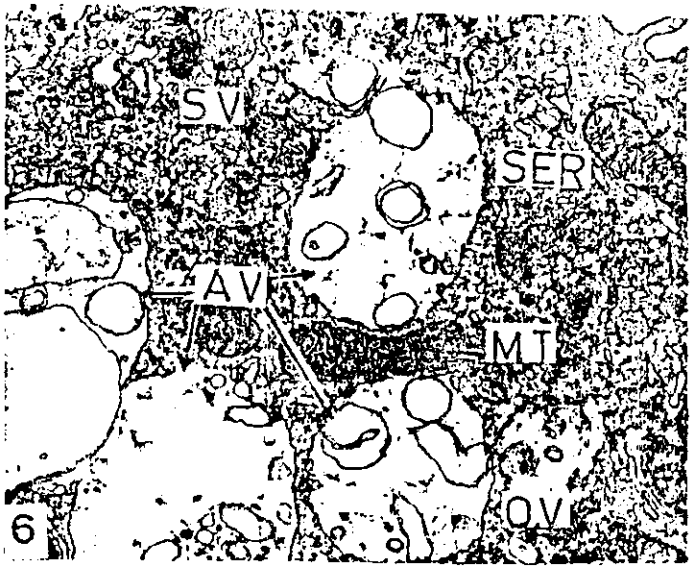

Fig. 7: An electron micrograph of two adjacent epithelial cells, showing interdigitations at the apical portion of the lateral walls with gap- and tight junctions. Secretory vacuoles, vesicles and empty vacuoles are predominating in the apical and middle region of the cells. Notice the different shapes and branched mitochondria. The tubules of the smooth endoplasmic reticulum are arranged parallel to the longitudinal axis of the cell. (X 16 000)

Fig. 8: An electron micrograph of the basal region of a cell, showing the tubules of the smooth endoplasmic reticulum are arranged horizontal to the axis of the cell. Notice the elongated and rounded mitochondria. (X 38 000)

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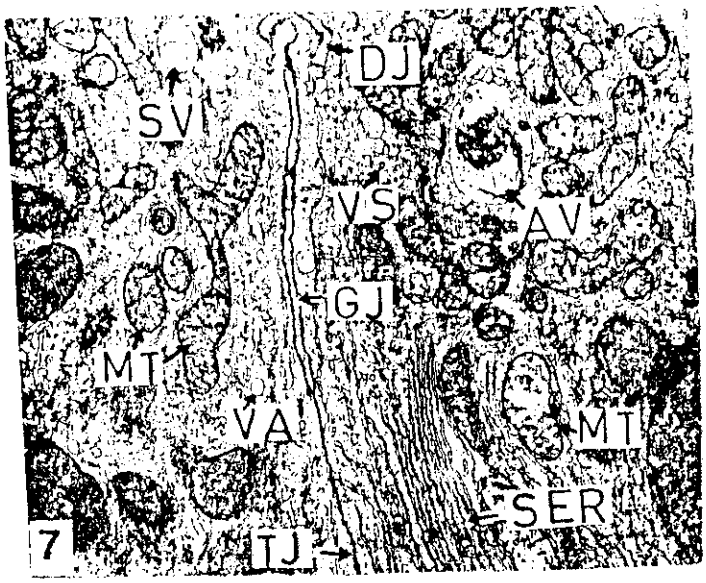
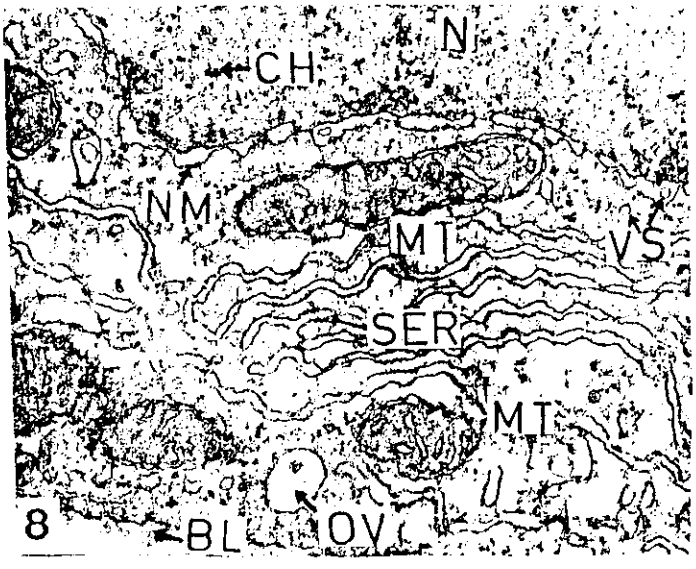
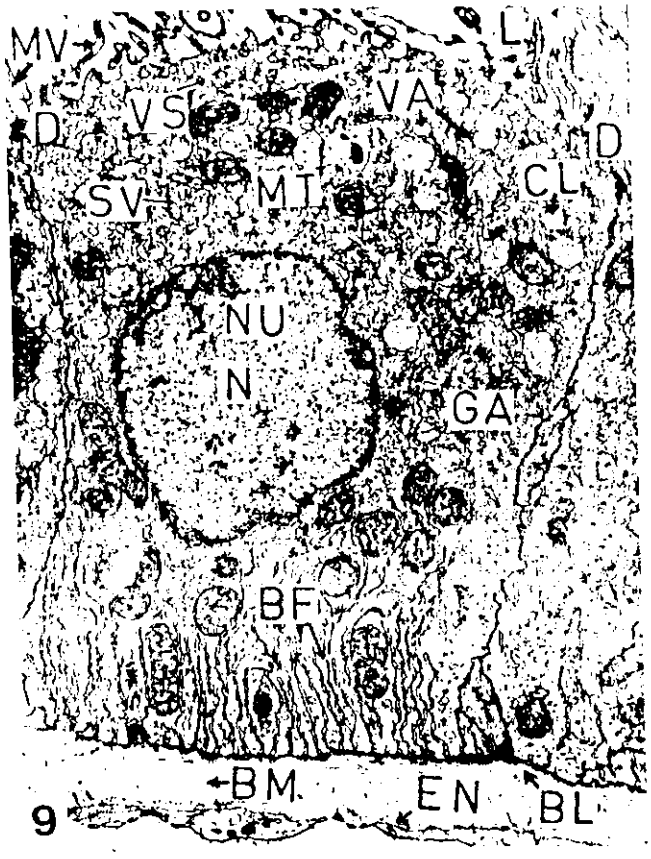




** Figures 9-13 represent the epithelial cells of the aglomerular mesonephric tubule of 150 mm long adult Halicampodes macrorhynchus (Bamber).

Fig 9: An electron micrograph of a cell with irregularly-shaped and centrally-placed nucleus. The mitochondria are mostly supranuclear and in the basal region of the cell. The basal region contains several infoldings of the basal plasmalemma. Endothelial cells of blood capillaries underneath the basal lamina possess many pores and diaphragmata.

(X 12 000)



9

Fig. 10: An electron micrograph of the apical portion of two cells cotaining secretory vacuoles with secretory granules. Notice the irregularly arranged microvilli and the Golgi complex is close to the irregular nucleus.
(X 16 000)

Fig. 11: An electron micrograph of the apical portion of two cells showing a desmosome with its microfilaments, vesicles, mono- and multivesicular bodies, microtubules, secretory vacuoles and empty vacuoles. (X 20 000)

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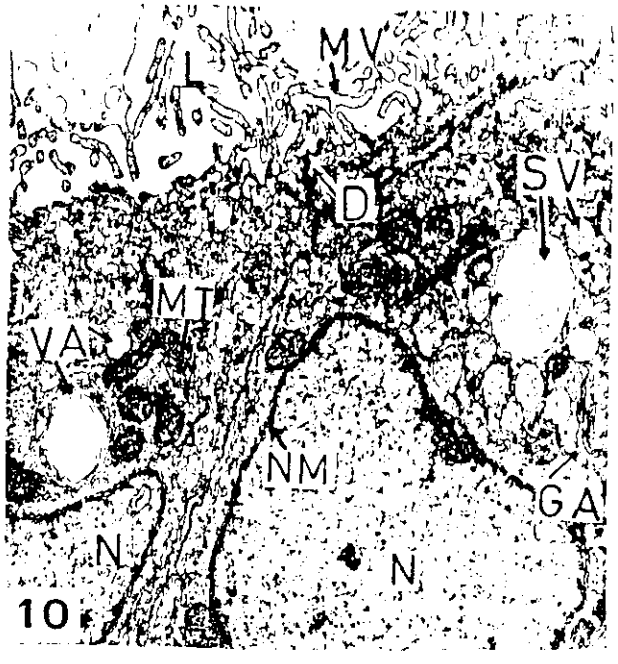

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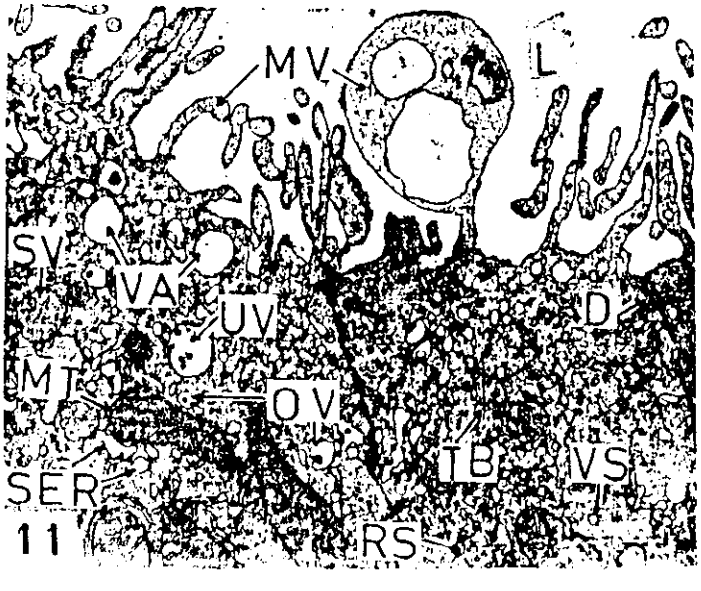

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Fig. 12: An electron micrograph of two cells showing smooth endoplasmic reticulum consisting of tubules and vacuoles, mitochondria with tubular cristae and electron-dense matrix ,the Golgi complex is composed of many saccules and vacuoles of various sizes. Notice the ribosomes in the form of clusters are freely distributed in the cytoplasm. (X 24 000)

Fig. 13: An electron micrograph of the basal portion of two cells showing basal infoldings extending deeply in to the cytoplasm, oval mitochondria, with electron-dense matrix between the basal infoldings and many vesicles and vacuoles. (X 40 000)

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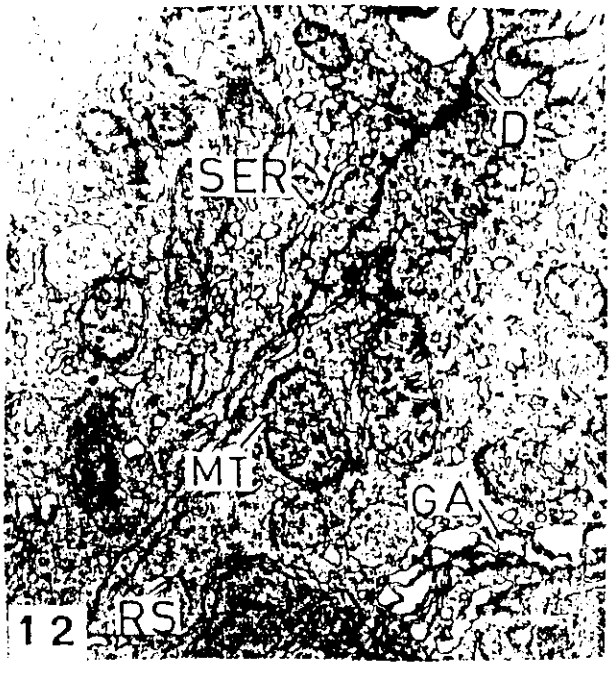

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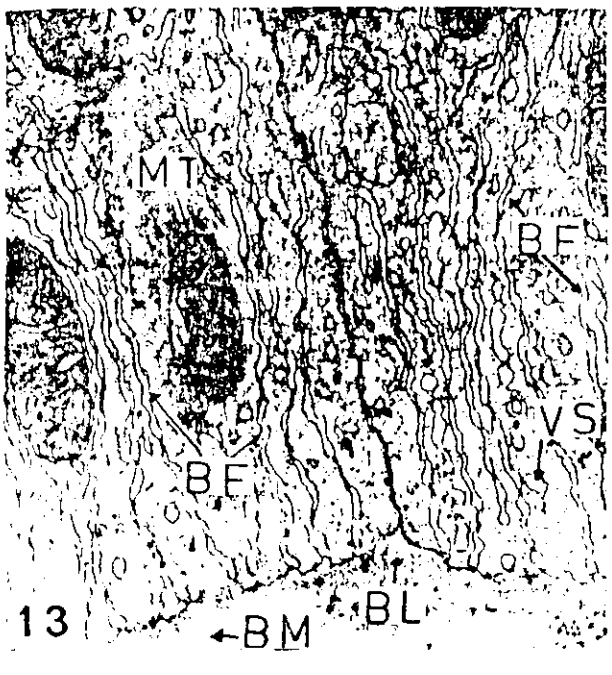

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التركيب الدقيق للوحدة البولية غير الجمعية فى الاطوار الجنينية والبالغة للسمكة المزمارية "هاليكامبوس ماكروريهينكس" (بامبر)

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تشبه طلائية قناة الكلية الامامية فى الأجنة نظيرتها فى قناة الكلية الوسطى للاطوار البالغة ، حيث يحتوى كل منهما على عدد قليل من البروزات الدقيقة عند سطحهما الحر ولا يوجد ثنيات داخلية فى الغشاء البلازمى القاعدى ، ويمكن اعتبارهما من نفس النوع والوظيفة وتسميان لذلك بالقناة الكلوية البدائية (الأركنيفرية). وأهم ما يميز خلايا قناة الكلية الامامية الجنينية وجود كلا النوعين من الشبكة الاندوبلازمية ، الخشن والاملس وأجسام سبحية كبيرة فى حجمها وفقيرة فى تكوين حواجزها الداخلية ومحتوياتها مما يجعل الاجنة قادرة على الاخراج حتى وهى مازالت داخل جيوب تربية ابائها.

أما طلائية قناة الكلية الوسطى فى الاطوار البالغة فتتميز بوجود عدد كبير من التجاويف الملتهمة الكبيرة الحجم تحتوى بداخلها على تركيبات غير متجانسة ومواد غريبة وكذلك تجاويف افرازية وعدد كبير من الاجسام السبحية صغيرة الحجم غزيرة الحواجز والمحتويات الداخلية وكذلك وجود الشبكة الاندوبلازمية الملساء فقط ، لذلك تستطيع قناة الكلية الوسطى افراز الاملاح والتخلص من المخلفات والتهام المواد الضارة داخل الخلية وكذلك اعادة امتصاص الماء من البول.

وبدراسة التركيب الدقيق لخلايا أنابيب الكلية الوسطى غير الجمعية وحيدة القطعة فى الاطوار البالغة لهذا النوع من الاسمك عديمة الجمع ، تبين وجود عدد كبير من البروزات الدقيقة والحويصلات الدقيقة والتجاويف والاجسام الحويصلية الاحادية والعديده وتجاويف افرازية مختلفة الاحجام وجهاز جولوجى جيد التكوين وكثير من عناقيد الريبوسومات المتجمعة مما

يؤكد وظيفة الخليـــة فى عمليـة افراز الاملاح الموجودة فى الدم ، كذلك وجود شييـات داخليـة قاعدية تمتد بعمـق داخل الخليـــة من الغشـــاء البلازمى القاعدى وعدد كبيـر من الاجسلم السـبحية والشبـكة الاندوبلازمية الملسـاء والحويصلات الدقيقة فى الجزء القاعدى لنفس الخلية يوضح وظيفة الخلية أيضا فى امتصاص الماء من البول لحفظ سوائل الجســم والخلايا فى حالة أقل تركيزا ، لدواعى التنظيم الاســموزى وذلك لملاءمـــة معيشـــة الاسماك فى المياة الملحـــة.