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Fig. 127. The urothelial-stromal interface 12 weeks after MNU treatment. In this instance a blood capillary (BC) appears to have entered the urothelium. X 6,000.

Fig. 128. Light micrograph of rat urothelium 24 weeks after MNU treatment showing a papilloma composed of transitional cells arranged around a central core of blood vessels and supporting stroma. Note the urothelium is 4 to 8 layers thick. Some intracytoplasmic luminae (IL) are observable in the superficial and intermediate cells. Basic Fuchsin-stained section. X 300.

Fig. 129. Transmission electron micrograph of superficial cells 24 weeks after MNU treatment showing the general appearance of these cells. Note the presence of pleomorphic microvilli (MV) on the surface. Profiles of rough endoplasmic reticulum (ER) are observable throughout the cytoplasm. IS, intercellular space; M, mitochondria; N, nucleus. X 6,000.

Fig. 130. An apical portion of a superficial cell 24 weeks after MNU treatment. The surface is covered with pleomorphic microvilli (MV) and a thick glycocalyx (GLY). ER, endoplasmic reticulum. X 45,000.

Fig. 131. The urothelial-stromal interface of a papilloma 24 weeks after MNU treatment showing the basal lamina (BL) and hemi-desmosome (HD). N, nucleus of basal cell; MF, microfilament; M, mitochondria. X 30,000.
Fig. 132. Transmission electron micrograph of the intermediate cells 24 weeks after MNU treatment showing well developed endoplasmic reticulum (ER) and severed Golgi apparatuses (GA). N, nucleus; D, desmosome. X 10,000.

Fig. 133. The luminal surface of urothelium in a papilloma 24 weeks after MNU treatment. Note the lack of a recognizable zonula occludens. An adherens type of junction (ZA) is present at the site. MV, microvilli; GLY, glycocalyx. X 100,000.

Fig. 134. Another transmission micrograph of intermediate cells 24 weeks after MNU treatment. Several profiles of rough endoplasmic reticulum (ER) are found throughout the cytoplasm. Microfibril bundles (MF) are not plentiful in these cells. D, desmosome. X 10,000.

Fig. 135. High power micrograph to show a desmosome (D) between two intermediate cells 24 weeks after MNU treatment. Note the bundle of microfilament (MF) which is associated with the desmosome. ER, endoplasmic reticulum. X 30,000.
Fig. 136. Superficial cells 24 weeks after MNU treatment showing continuity of the intercellular lumina (IL) with the luminal membrane. Both are profusely covered with pleomorphic microvilli (MV). X 10,000.

Fig. 137. The urothelial-stromal interface 24 weeks after MNU treatment showing the general appearance of the basal cells and the supporting stroma. Note the bundles of microfilaments (MF) in the basal cells and the small amount of collagen fibres (CF) in the stroma. BC, blood capillary; Ly, lymphocyte. X 6,000.

Figs. 138 and 139. Transmission electron micrographs of the luminal membrane of urothelium 24 weeks after the MNU treatment. The cells are profusely covered with pleomorphic microvilli (MV) and their luminal aspect is covered with the thick glycocalyx (GLY). In certain locations, the symmetrical nature of the luminal membrane (SUM) is discernible. X 100,000.
Fig. 140. The urothelial-stromal interface 24 weeks after MNU treatment showing basal cell pseudopedia (PP) projecting through gap in the basal lamina (BL) into the submucosa. HD, hemi-desmosome. X 15,000.

Fig. 141. Transmission electron micrograph of superficial and intermediate cells 24 weeks after MNU treatment showing the presence of intracytoplasmic lumina (IL1) in intermediate and supraficial cells and intercullar lumina (IL2) between superficial and intermediate cells. Note the presence of pleomorphic microvilli projecting into the luminae as of the luminal surface. X 6,000.

Fig. 142. A low power scanning electron micrograph of the urinary face of the bladder 24 weeks after the termination of the MNU instillation, showing numerous papillomas protruding into the bladder lumen. X 160.

Fig. 143. Another scanning electron micrograph of the luminal surface of a papilloma 24 weeks after MNU treatment showing tunnel-like formations. Some erythrocytes are also visible on the luminal surface. X 1,600.
Fig. 144. A high power scanning electron micrograph of the luminal surface of a papilloma 24 weeks after MNU treatment showing numerous microvilli. X 32,000.

Fig. 145. Light micrograph of a human type I carcinoma in situ. The urothelium is variable in thickness. There is an apparent lack of intercellular cohesiveness. Note the relatively large nuclei of the cells. In the urinary face not, also some large cells which appear to be in the process of desquamation. Arrow points to a urothelial cells probably migrating into the sub-mucosa. Basic Fuchsin-stained section. X 750.

Fig. 146. Transmission electron micrograph of the apical portions of superficial cells in human type I carcinoma in situ. Note the degenerating mitochondria (M) and the lack of any other recognisable organelles or cytoplasmic constituents. X 11,250.

Fig. 147. Transmission electron micrograph of the urothelial-stromal interface in human type I carcinoma in situ. The basal lamina (BL) on the right hand side of the picture is thick with more than one lamina densa. Note also the absence of desmosomes between the intermediate and basal cells, and hemi-desmosomes in the basal border of the basal cells. Inv., invagination of the basal plasma membrane of the basal cell. X 11,250.

Fig. 148. Scanning electron micrograph of the luminal surface of human type I carcinoma in situ showing the irregular arrangement of small cells in the deeper layers of this lesion. Large cells as seen in LM preparations - Fig. 145 - were never found. X 4,800.
Fig. 149. Transmission electron micrograph of the intermediate cells in human type I carcinoma in situ. Note the presence of scattered profiles of rough endoplasmic reticulum (ER) and the independent Golgi complexes (GC). Arrows point to small vesicles similar to those found in the region of Golgi complexes. M, mitochondria; N, nucleus. X 20,000.

Fig. 150. Transmission electron micrograph of human type I carcinoma in situ showing apparent lack of intercellular cohesiveness and the absence of intercellular junctions. Note the nuclei (N) which occupy large areas of the cells and contain large amount of condensed chromatin and a prominent nucleoli (Nu). X 6,000. Inset. An incompletely formed desmosome (D) between two intermediate cells. X 30,000.

Fig. 151. Transmission electron micrograph of the urothelial-stromal interface of human type I carcinoma in situ. An urothelial cell (UC) appears to have entered the sub-mucosa. The basal lamina (BL) is multiple. ER, endoplasmic reticulum; GA, Golgi apparatus; M, mitochondria. X 15,000.

Fig. 152. Light micrograph of human type II carcinoma in situ. The urothelium is 5 to 7 layers thick. Note the presence of intracytoplasmic lumina (IL) in the superficial and intermediate cells and also the lucent patches in the sub-mucosa immediately under the urothelium. The superficial cells are large and cuboidal and pale. The intermediate and basal cells are spindle shaped and their nuclei are deeply stained and occupy relatively large areas of the cells. X 750.
Fig. 153. Transmission electron micrograph of the apical portion of a superficial cell in human type II carcinoma in situ. Note the presence of mitochondria (M) which have electron dense matrix and attenuated cristae. Note also the surface is smooth and flexible with the crests of the wavy contour appearing as sporadic microvilli. RV, rounded vesicles. X 4,500.

Fig. 154. Scanning electron micrograph of the luminal surface of human type II carcinoma in situ. The surface of the large luminal cells is mostly smooth with ridges and occasional microvilli-like processes. X 4,800.

Fig. 155. Transmission electron micrograph of the intermediate cells in human type II carcinoma in situ. The nuclei (N) contain large amount of condensed chromatin and large nucleoli (Nu). Also note the presence of a slight dense amorphous material (AM) in the intercellular cisternal space. Ly, lymphocyte; NI, nuclear inclusion; G, aggregation of particles in nucleus, GA, Golgi apparatus; D, desmosome. X 15,000.

Fig. 156. Transmission electron micrograph of human type II carcinoma in situ showing pinocytotic activity along the border of an intermediate cell (arrows). Note the presence of amorphous material in the intercellular cisternal space. GA, Golgi apparatus; ER, endoplasmic reticulum. X 30,000.
Fig. 157. Transmission electron micrograph of human type II carcinoma in situ showing cytoplasmic projections of the basal urothelial cells invading the sub-mucosa. The basal lamina forms a network in places where several lamina densa are noticeable. Also note that the zone of connective tissue adjoining the basal cell processes contains only a few collagen fibrils and hardly any other connective tissue elements. X, 4,500.

Fig. 158. Transmission electron micrograph of human type II carcinoma in situ showing focal break in the basal lamina in region immediately adjacent to intercellular cisternal space (arrow). Note that the adjoining zone of connective tissue contains only fragments of collagen fibrils. Also observable are electron lucent patches (elp) in the sub-mucosa. A finely amorphous substance in the intercellular cisternal space is continuous with a similar substance in the sub-mucosa. BL, basal lamina. X 15,000.

Fig. 159. Transmission electron micrograph of human type II carcinoma in situ showing another instance of cytoplasmic projections of a basal urothelial cell invading the sub-mucosa. Note the basal lamina forming an irregular network around the projection. Also note the amorphous substances in both the urothelial extracellular space and the adjoining sub-mucosa. The cytoplasmic projection of the basal cell contains small vesicles (arrows) close to the plasma membrane. X 12,500.

Fig. 160. Transmission electron micrograph of an apical portion of a large superficial cell in human grade I papillary carcinoma. Note the luminal surface has a scalloped appearance with microvilli at the crests. The surface displays a glycocalyx. The tight junction (ZO?) seems to be rather attenuated. RV, rounded vesicles limited by symmetrical membrane. The luminal membrane is also symmetrical in structure. M, mitochondria; ER, endoplasmic reticulum. X 30,000.
Fig. 161. Transmission electron micrograph of an apical portion of a large superficial cell in human grade I carcinoma. Note the luminal surface has a simple wavy outline with sparsely distributed microvilli (MV). A glycocalyx is quite evident. X 20,000.
Fig. 162. Transmission electron micrograph of an apical portion of a small superficial cell in human grade I carcinoma. The luminal surface shows more microvilli (MV) than the large cells. Note that the microvilli are of variable dimensions and some are branched. RV, rounded vesicles; M, mitochondria. X 40,000.

Fig. 163. Transmission electron micrograph of urothelial-stromal interface in human grade I carcinoma. The basal lamina (BL) is very thick and reduplicated several times. BC, blood capillary. X 15,000.

Fig. 164. The urothelial-stromal interface in grade I carcinoma. The basal lamina (BL) is thick but rarefied with electron-lucent patches, and it closely follows the tiny projections from the basal cells. The adjacent connective tissue also has electron-lucent areas and collagen fibrils apparently undergoing dissolution. X 22,500.

Fig. 165. Scanning electron micrograph of the luminal surface of small superficial cells in human grade I carcinoma showing uniformly distributed microvilli. X 32,000.
Fig. 166. Transmission electron micrograph of an intermediate cell in a focal area of human grade I carcinoma. Note the well developed rough endoplasmic reticulum (ER) and Golgi apparatuses (GA). The nucleus has a coarse, granular appearance. M, mitochondria; N, nucleus. X 20,000.

Fig. 167. Another transmission electron micrograph of an intermediate cell in a focal area of human grade I carcinoma. The perinuclear area of the cytoplasm is filled with microfilaments (MF). The nucleus (N) has a coarse granular appearance with clusters of granules of different sizes. M, mitochondria. X 20,000.
Figs. 168 and 169. Transmission electron micrographs of apical portions of superficial cells in human grade II papillary carcinoma. The luminal surfaces show numerous pleomorphic microvilli (MV) which are covered with thick and dense glycocalyx (GLY). V, vesicles; M, mitochondria; GL, glycogen particles; IL, intracytoplasmic lumina; D, desmosomes. Fig. 168 X 10,000 and Fig. 169. X 20,000.

Fig. 170. Scanning electron micrograph of the luminal surface of a human grade II papillary carcinoma showing numerous pleomorphic microvilli. Some microvilli are branched. X 32,000.
Fig. 171. A low power scanning electron micrograph of an area of the luminal surface of normal urothelium from a young adult treated sequentially with Con A and RBCs. Very few RBCs are present and they may be trapped in artificial gaps between cells. X 1,000.

Fig. 172. A low power scanning electron micrograph of an area of the luminal surface of young adult treated with WGA and RBCs. The few RBCs present are probably trapped between cells. X 1,000.

Fig. 173. Scanning electron micrograph to show Con A-mediated RBCs adsorption onto the luminal surface of normal urothelium of elderly subjects. Many RBCs are present and at least some are clearly on cell surfaces and apparently not trapped in gaps between cells. X 3,000.

Fig. 174. WGA-mediated RBCs adsorption to an area of the luminal surface of normal, elderly urothelium. Again, the RBCs are present on the surface of cells and not trapped in gaps between cells. X 3,000.
Fig. 175. A SEM preparation showing Con A-mediated RBCs adsorption to the luminal surface of grade 1 papillary carcinoma. Numerous RBCs are present, some of which show altered morphologies. DC, discocyte; EC, echinocyte. X 3,000.

Fig. 176. The surface of grade I Papillary carcinoma as seen in SEM following treatment with WGA and RBCs. Many RBCs are adsorbed onto the surface. DC, discocyte; EC, echinocyte. X 3,000.

Fig. 177. Scanning electron micrograph of the luminal surface of grade I papillary carcinoma showing adsorption of numerous RBCs after coating with PHA. The RBCs are predominantly in the form of elliptocytes (ELC). X 3,000.

Fig. 178. A high power scanning electron micrograph of an area of the luminal surface of normal urothelium from a young adult treated sequentially with Con A and haemocyanin. Very few haemocyanin molecules are visible. X 20,000.
Fig. 179. A high power SEM preparation of the luminal surface of normal aged urothelium treated with Con A and haemocyanin to show the large number of mark molecules present. Apart from single molecules, a number of clusters are visible. X 20,000.

Fig. 180. The surface of grade I papillary carcinoma as seen in SEM following Con A-mediated, haemocyanin adsorption. It may be noted that there are many more clusters of haemocyanin on the microvillous surface than on the smooth surface. A few scattered, individual molecules are present on the smooth surface (in the lower left hand corner of the micrograph). X 20,000.

Fig. 181. A high power scanning electron micrograph showing the distribution of haemocyanin and the surface of grade II papillary carcinoma. The number of clusters is greater than in grade I carcinoma, although individual molecules are still discernible. X 20,000.