Collagen Fibrils within the Renal Glomerulus.* By Eichi Yamada.‡ (*From The Rockefeller Institute.*)§

The fine structure of the frog glomerulus has been described in detail by Pak Poy (2); the present observations confirm his findings as far as its principal structure is concerned. He pointed out that the main morphological difference between the frog glomerulus and those of mammals is in the basement membrane, that is, the structure between endothelial and epithelial (podocyte) cells. Beneath the epithelial lining, a homogeneous, vaguely defined, dense membrane about 200 mμ thick can be seen which seems to be homologous in structure with the lamina densa of the basement membrane in the mouse glomerulus (3). It is noteworthy that in the frog glomerulus, no special differentiation of the ground substance is evident along the endothelial cell lining. The space between the lamina densa and the endothelial cells is occupied by a fine reticular or fibrillar ground substance which shows variable width in section. It is in this space that a cell (called the pericapillary cell by Pak Poy) and the profiles of its processes are encountered.

For the purposes of this study, the kidney of the frog, *Rana pipiens* Schreber, was fixed with osmium-sucrose mixture reported by Caulfield (6) and embedded in methacrylate. The sections were stained with 2 per cent uranyl acetate solution according to the method described by Watson (1), and subsequently blanketed between formvar and carbon films.

Even under low magnification (Fig. 1), one can recognize the presence of dense fibers running apparently at random in the ground substance between the lamina densa and the endothelial cell. In higher magnification, these fibers are about 55 mμ in diameter and show the characteristic fine cross-striation of collagen fibrils, namely, 640 A period and six intraperiod bands (Fig. 2 and insert). It is to be noted that the relationship between these fibrils and the surface of the pericapillary cell is often quite intimate. These fibrils are recognized in the axial portion of the capillary loop as well as the peripheral, although their relative localization to the vascular pole of the glomerulus is not clear.

Collagen fibrils have not heretofore been observed by electron microscopy within the glomerulus, although it is generally assumed that the basement membrane is part of the connective tissue in nature, and the presence of reticular or argyrophilic fibers has been reported from light microscope studies (4, 5).

It is, however, clear that collagen fibrils do exist within the glomerulus of the frog and the location of the fibrils suggests that the pericapillary cells may play some role in producing them. Since, however, collagen fibrils were not observable in all glomeruli examined and the number of the glomeruli as well as animals used in this study were limited, the possibility remains that the fibrils may be associated with otherwise unrecognizable pathological changes.

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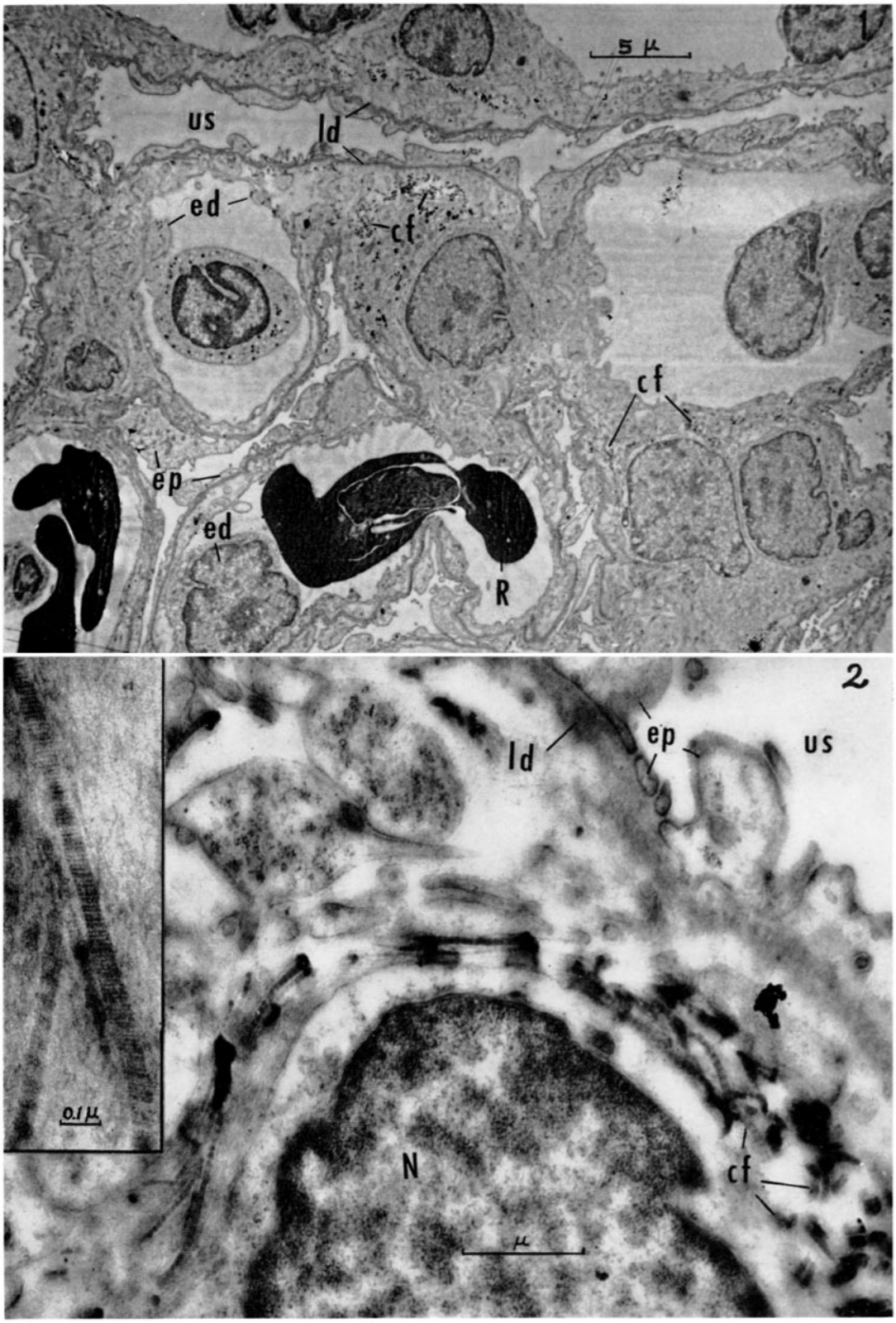
EXPLANATION OF PLATE 223

FIG. 1. General view of a part of the frog glomerulus. Even under this magnification, one can recognize the collagenous fibers (*cf*) in the space between the capillary endothelial cell (*ed*) and epithelial cell (podocyte) (*ep*). The lamina densa (*ld*) of the basement membrane is prominent along the epithelial cell lining. *us:* urinary space. *R:* red blood cell. × 3,250.

FIG. 2. Detail of a portion of the glomerulus. Collagenous fibers (*cf*) with characteristic cross-striation are clearly shown. *N:* nucleus of the pericapillary cell. *us:* urinary space. *ld:* lamina densa. *ep:* processes of the epithelial cell. × 19,500. *Insert.* Higher magnification of a part of Fig. 2, showing the characteristic cross-striation of collagen fiber. Note the fine fibrillar ground substance around the fibers. × 66,000.



(Yamada: Collagen fibrils in renal glomerulus)