Absence of Juxtaglomerular Cells in the Kidneys of Freshwater Stingrays and Primitive Bony Fishes*¹

Mikio Oguri*²

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The juxtaglomerular (JG) cells in the mammalian kidneys are known to secrete a kidney hormone called renin. JG cells are present also in the kidneys of holocephalian and teleostean fishes. However, the kidneys of cyclostomes and elasmobranchs are lacking in these cells. The present histological investigations using Bowie's stain were performed to clarify whether or not JG cells are present in the kidneys of South American freshwater stingrays *Potamotrygon* spp., the sterlet *Acipenser ruthenus*, the bester (intergeneric hybrid of *A. ruthenus* ♂ × *Huso huso* ♀), and the longnose gar *Lepisosteus osseus*. However, JG cells were not detectable in the kidneys of any these fishes investigated.

Juxtaglomerular (JG) cells of the mammalian kidney are known to secrete renin, a kidney hormone, playing important roles in the blood pressure, aldosterone secretion and water intake.^{1,2)} These cells are also present in the kidneys of lower vertebrates such as teleosts²⁻¹¹⁾ and holocephalans.^{2,12,13)} However, JG cells are absent in the kidneys of cyclostomes and marine elasmobranchs.^{2-4,14-16)}

As for the primitive bony fishes, some contradictory findings are reported in the previous studies.^{7,12)} JG cells have been investigated hitherto using six species of these primitive bony fishes and their absence has been reported in five species.^{6,7,12)} However, in one species, longnose gar (*Lepisosteus osseus*), absence of JG cells and their presence have been reported by Ogawa *et al.*⁷⁾ and Nishimura *et al.*¹²⁾ respectively.

To reexamine this contradictory finding, the present investigation was carried out, using three species of the primitive bony fishes, including the longnose gar. Reinvestigation was also done on the absence of JG cells in the freshwater stingrays, which were examined previously^{14,15)} using limited materials. So, the present paper deals with the both results obtained.

Materials and Method

The fish species used in the present examination are as follows; freshwater stingrays *Potamotrygon*

spp. (6 specimens, 98-187 g in body weight), sterlet *Acipenser ruthenus* (4 specimens, 7-11 g), bester (intergeneric hybrid of *A. ruthenus* ♂ × *Huso huso* ♀, 3 specimens, 325-465 g), and longnose gar *L. osseus* (6 specimens, 70-120 g). Freshwater stingrays were obtained from Tokyo Aquarium Co. Ltd. Bester was supplied from Mie Prefectural Inland Fisheries Experimental Station, Komono. Sterlet and longnose gar were purchased from a fish dealer in Nagoya City. In the present paper, I report the scientific name of the freshwater stingrays only as *P. spp.* because of the confused taxonomic status in the genus *Potamotrygon*,^{17,18)} and of no available information on the collecting stations of these stingrays in the South American rivers, which is necessary to identify fish species.

From these fishes several portions of the kidneys were removed and fixed in Helly's fluid. After ethanol dehydration, these fixed kidney tissues were embedded in paraffin and sectioned at a thickness of 6 to 7 μ m. The sections were stained with Bowie's method for the demonstration of JG cells or Mayer's acid hemalum and eosin for general light microscopy.

Results and Discussion

Careful examinations were carried out on the kidney of the South American freshwater stingrays *P. spp.*, but the JG cells were not detectable in the vicinity of renal glomeruli (Fig. 1). The

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*² Laboratory of Fish Biology, Faculty of Agriculture, Nagoya University, Nagoya 464, Japan (小栗幹郎; 名古屋大学農学部)

same result has been reported in our previous study on the absence of JG cells in the kidney of cyclostomes and elasmobranchs.^{14,15)} In this study,^{14,15)} we could examine the kidney of the freshwater stingray *P. circularis* provided kindly by Dr. T. B. Thorson, University of Nebraska, U.S.A. But, available kidneys were only from two specimens of the stingray. Thus, investigation on more number of specimens was necessary to get definite conclusion on their absence. So, in the present study I tried reexamination on the absence of JG cells using six specimens of the freshwater stingrays, which are now available as living fish imported from the South America. However, the result of the investigation was the same as in the previous examination^{14,15)} and the JG cells could not be observed in the kidney of the freshwater stingrays, which are similar to freshwater teleosts in viewpoint of body fluid.^{10,20)} Crockett *et al.*¹⁶⁾ have briefly reported also the absence of JG cells in the kidney of freshwater stingray *P. motoro*. Accordingly, it is now concluded that the JG cells are absent in the kidney of freshwater stingrays, as well as in the kidney of marine elasmobranchs, even though the renin-like substance seems to be contained in the kidney of the dogfish *Scyliorhinus canicula*.²¹⁾

Also, detailed observations on the kidney tissue were made using the sterlet, the bester and the longnose gar. However, JG cells could not be detected in the wall of small blood vessels near the renal glomeruli of these three species of primitive bony fishes (Figs. 2-4). During this examination, I noticed that kidney observation on these primitive bony fishes should be careful, because abundant granulocytes detectable in their interstitial tissue are also stainable in bluish-purple, purplish-red or red colour with Bowie's method (Figs. 2-4). When these granulocytes are located closely to the small blood vessels near the renal glomeruli, misidentification as JG cells must be avoided. Krishnamurthy and Bern⁹⁾ reported the absence of JG cells in the kidney of the Pacific coast white sturgeon *Acipenser transmontanus*. Furthermore, Ogawa *et al.*⁷⁾ and Nishimura *et al.*¹²⁾ reported also the absence of JG cells in the kidney of the following four species of primitive bony fishes, bowfin *Amia calva*, shortnose sturgeon *A. brevirostris*, Nile bichir *Polypterus senegalus*, and reed fish *Calamoichthys calabaricus*. On the other hand, as for JG cells in longnose gar *L. osseus*, the results of the previous examinations are contradictory; the absence of JG cells was de-

scribed by Ogawa *et al.*,⁷⁾ and their presence was reported by Nishimura *et al.*¹²⁾ However, the results of the present study is in accordance with the former result⁷⁾ and the JG cells could not be detected in the kidney of longnose gar *L. osseus*.

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Explanation of Figures 1-4

Fig. 1. Kidney tissue of the South American freshwater stingray *Potamotrygon* sp. $\times 415$

Figs. 2-4. Kidney tissues of the primitive bony fishes.

Fig. 2. Sterlet *Acipenser ruthenus*. $\times 600$

Fig. 3. Bester, intergeneric hybrid of *A. ruthenus* $\times$ *Huso huso*. $\times 480$

Fig. 4. Longnose gar *Lepisosteus osseus*. $\times 930$

Gl: glomerulus. Arrow and star indicate Bowie-positive granulocyte and afferent arteriole, respectively. Helly's fluid and Bowie's stain.