

aquatic bird life on Lake Atitlán (Auk, 1960). It is hoped that poaching, which is still popular, will diminish under these conditions. There is every possibility that these remarkable birds will continue to hold their own and even increase in numbers.

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Additional Cases of Bilobated Kidneys in the Hornbills.—A few authors have noted the fact that the hornbills (Bucerotidae) have a two-lobed instead of the normal three-lobed kidney. Van Tyne and Berger (1959: 38) mention that some hornbills, unlike other birds, possess a bilobed kidney. Das (1924: 767) reported that the Grey Hornbill (*Ocyrceros* [*Tockus*] *griseus*) consists of "two lobes only, the anterior and posterior, the middle lobe being absent."

Three additional species, *Buceros hydrocorax*, *Ceratogymna atrata*, and *Anthraceros malabaricus*, can be added. The first two are based on specimens from National Zoological Park fatalities, which although eviscerated still contained the renal masses. The last is based on a wild bird examined by me. My interest at the time lay in the circulatory system, and, although the visceral circulation was absent, along with some of the systemic arch, enough remained to be of use. In this respect two of the forms examined had a different arrangement of the ischiadic artery.

In mammals the development of the pyramidal lobe structure is related to the size of the kidney, and this in turn to the size of the animal. As Smith (1951: 6) stated: "The limitations set by the maximal length of tubule leads to the replacement of one solitary big kidney by a multilobular organ composed in effect of smaller ones. . . . This lobulation . . . results in the formation of a variable number of *pyramids*, each pyramid generally draining into the renal pelvis by an independent papilla. In many mammals, however, the kidney is divided into a number of lobes so nearly independent that they are virtually separate kidneys."

The two widely separated lobes of the kidney in hornbills produce the condition described by Smith as "virtually separate kidneys." This condition is more marked than in mammals, because the avian kidney, unlike that in mammals, does not possess a hilum. There is no renal pelvis present to serve as a focal point from which vascular radiation may occur. Such an arrangement would favor the appearance of independent renal lobes. This is apparently the case in all birds and some reptiles, where the kidneys are lobulated but not because of the limitations placed upon the nephronic tubules as in mammals.

Figures 1 and 2 show the ventral synsacral region in *Buceros* and *Ceratogymna*. An interesting condition of the arterial supply occurs in the distribution of the ischiadic artery. In *Ceratogymna* as well as *Anthraceros* the normal pattern prevails; that is, the renal arteries arise from the ischiadic before it passes to the leg. *Buceros*, however, has the ischiadic artery entering the posterior lobe and ramifying there, but not entering the leg. The areas normally supplied by this vessel are taken

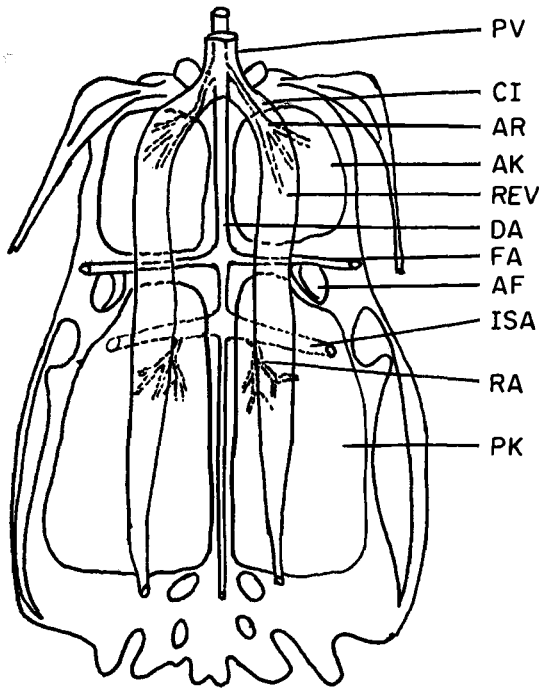


Figure 1. *Ceratogymna atrata*. Diagram of ventral pelvic and synsacral area. Abbreviations: AF Acetabular fossa; AK Anterior kidney lobe; AR Anterior renal artery; CI Common iliac vein; DA Dorsal aorta; FA Femoral artery; ISA Ischiadic artery; PK Posterior kidney lobe; PV Posterior vena cava; RA Renal artery; REV Efferent renal vein.

over by the femoral artery. An arterial supply such as this is not typical of the Bucerotidae, since this is the only reported instance of such an occurrence. Garrod (1873: 632) does not mention this arrangement in the six species of hornbills that he studied, nor does he note a separation of the renal lobes.

The position of the vessels is also noteworthy. My specimen of *Buceros* had the "ischiodic" artery displaced farther caudad than in *Ceratogymna*. In none of the other specimens that I studied is there such a distance between the femoral and ischiadic arteries. In *Anthracoeros* there may be present a vestige of the median lobe still attached to the anterior lobe as a small segment located on the postero-median border of the anterior lobe.

The appearance of renal lobe separations is not confined to the hornbills. Subsequent search has shown that other birds also possess this character. However, the major difference is that all the cases to be cited retain the three renal lobes.

Individual specimens of *Streptopelia chinensis* have anterior lobes separated from the slightly connected median and posterior lobes. A specimen of *Halcyon smyrensis* was quite similar, except that the median and posterior renal lobes were strongly

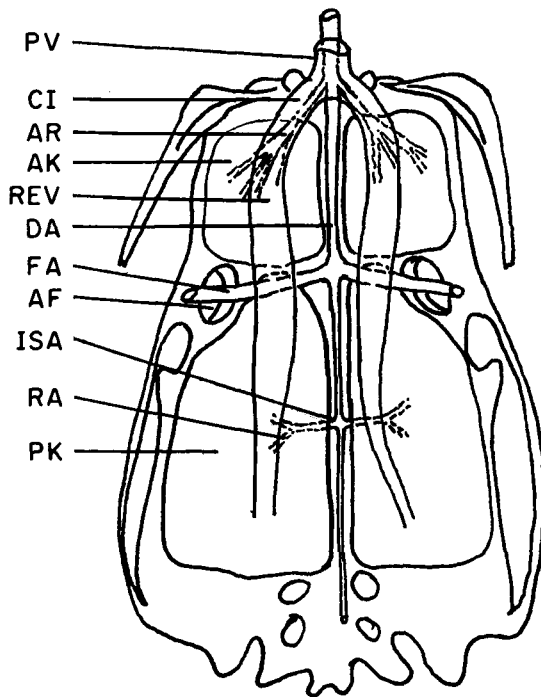


Figure 2. *Buceros hydrocorax*. Diagram of ventral pelvic and synsacral area. Abbreviations as in Figure 1.

united. *Centropus sinensis*, *Eurystomus orientalis*, and *Ninox scutulata* had their anterior and median lobes united, but separated from the posterior lobe.

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Behavior during Migratory Departure of White-throated Sparrows.—Concentrations of White-throated Sparrows (*Zonotrichia albicollis*), in both spring and fall migration, are regularly observed from my third-floor Toronto apartment, from which I have an excellent westward view of surrounding gardens and treetops. The