XV. *On the urinary organs and secretions of some of the amphibia.* *By* John Davy, *M. D. F. R. S. Communicated by the Society for the Improvement of Animal Chemistry.*

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THE urinary organs of the amphibia have been imperfectly described by authors; but I am not aware that any account has hitherto been published of the urinary secretion of any of this class of animals.

Since I have been in Ceylon, both subjects have excited my attention, and on both I have had favourable opportunities of gratifying my curiosity. It may not be uninteresting to the Society, to know the results of my observations. I shall briefly state them, confined as they are at present to a few animals of four natural families.

1. *Of the urinary organs, and urine of serpents.*

The kidneys of the different kinds of serpents I have examined, resemble each other generally; though in each kind, there are minute and trifling differences. In every instance, the kidneys are very large, nearly equal in size to the liver; they are long and narrow, and very lobulated; like some of the mammalia with conglomerate kidneys, they are destitute of a pelvis; each lobule sends a small duct to the ureter, which leaves the kidney in two branches. The ureters in general terminate in a single papilla. The papilla is situated in the

cloaca between the mouths of the oviducts; it is a little elevated above the surface, and its point is directed towards a receptacle into which the urine enters. The receptacle is a continuation of the intestine, yet it may be considered distinct both from the rectum and cloaca, with both of which it communicates only by means of sphincter orifices. This conformation of parts may be seen to advantage in large species of snakes. I first observed it in the rock-snake and the rat-snake, two species of coluber, frequently found from eight to ten feet long.

The urinary ducts of serpents are frequently of an opaque white colour, from a white matter which they contain, which is visible through their transparent coats, and which may be expressed and collected from the papilla in small quantities for examination. More or less of a similar white matter is almost constantly found in the receptacle; generally it is found in soft lumps, rarely in hard masses. In the receptacle, I have always observed it pure and entirely free from fæcal matter. This solid urine, for such it is in reality, gradually accumulates in the receptacle, till it forms the masses just described. It is a long time thus collecting, from three weeks to a month or six weeks. When the bulk of the masses is so considerable as to distend the part, they are expelled by an unusual exertion of the animal, most commonly in the act of devouring its food, which it takes periodically, at intervals of from three to six weeks. The urine is voided occasionally, accompanied by, but never mixed with, fæces. When expelled, it is commonly in a soft state, of a butyraceous consistence, which it loses from exposure to the air, and becomes hard and like chalk in appearance. This change is produced, I believe, merely by the evaporation of moisture. The quantity of solid urine secreted

by snakes is very great, more even than might be expected from the size of their kidneys; it is not unusual to see masses weighing three or four ounces, voided by large snakes.

The chemical nature of this urine was such as I expected to find it; I say expected, because before I left England, I was told by Dr. PROUT, that he had examined the excrement of a serpent in London, and had ascertained that it was nearly pure uric acid; such have I found it here in every instance, in at least eight that I have tried it; and the properties of that fresh from the ureter, were precisely the same as of that contained in the receptacle, or of that voided. Before the blow-pipe, it emitted strong ammoniacal fumes, consumed without flame, and afforded only a very minute quantity of ash, consisting chiefly of phosphate of lime, and a fixed alkaline phosphate, and a little carbonate of lime; in muriatic acid it was insoluble; in warm dilute nitric acid it was soluble with effervescence; and the solution evaporated, afforded the pink residue almost peculiar to uric acid; in an alkaline ley it was soluble, and the solution was precipitated by muriatic acid. These properties sufficiently prove, that the nature of the urine of snakes is as above stated. Besides uric acid, I have not been able to detect any other ingredient, nor do I believe that the urine contains any other, with the exception of a little dilute mucus, with which it is mixed and lubricated.

2. *Of the urinary organs, and urine of lizards.*

I have examined the urinary organs of four different species of lizard, the gecko iguana, a large species resembling the iguana, called by the natives kobbera-guion,* and the

* For an account of this animal, see KNOX's History of Ceylon.

alligator. The shape of the kidney varies in different instances; to each ureter there is a papilla, and the papillæ are situated in the receptacle itself; and in no other respect have I been able to discover between the urinary organs of these lizards and of snakes, any material difference. Neither does the urinary secretion of these four species, and of many other species that I have examined, differ from that of snakes in its essential nature; in every instance I have found it nearly pure uric acid. The uric acid of the alligator contains a large proportion of carbonate and phosphate of lime. Two specimens of this urine, from different alligators, agreed in this circumstance; they differed however in one having no odour, and the other a strong one of musk; the former was from a very young, the other was from an older animal.

3. *Of the urinary organs and urine of the turtle and tortoise.*

The kidneys of the testudo mydas, and geometrica, the only species I have hitherto examined, resemble those of the preceding animals in their lobulated structure. The proportional size of the kidney of snakes is greatest; that of lizards next; and that of the animals we are now considering, least.

In the bladder, both of the turtle and tortoise, I have found flakes of pure uric acid, but in no great abundance: it was in a transparent watery fluid, containing a little mucus and common salt, but no urea or any other substance that I could detect in the small quantity on which I operated.

It is curious to observe the links by which animals, in appearance totally dissimilar, are connected together. That there should be so close an analogy between the urinary organs and secretion of the serpent, lizard, and testudo, is

not surprising, their organic structure, and their habits and economy being so similar; but that an analogy should exist between animals so very different in general appearance as birds and amphibia, is not a little singular, yet it is true: the urinary organs of one class, as well as the lungs, primæ viæ and genital organs, resemble those of the other, and both are peculiar in secreting uric acid; those living entirely on animal food secreting it pure.